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ASTM BULLETIN

Published by
**AMERICAN SOCIETY for
TESTING MATERIALS**

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ASTM Bulletin, December, 1940. Published six times a year. January, March, May, August, October, and December, by the American Society for Testing Materials. Publication Office—20th and Northampton Sts., Easton, Pa. Editorial and advertising offices at the headquarters of the Society, 260 S. Broad St., Philadelphia, Pa. Subscription \$1.50 a year in United States and possessions, \$1.75 in Canada, \$2.00 in foreign countries. Single Copies—25 cents. Number 107. Entered as second class matter April 8, 1940, at the post office at Easton, Pa., under the act of March 3, 1879.

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DECEMBER—1940

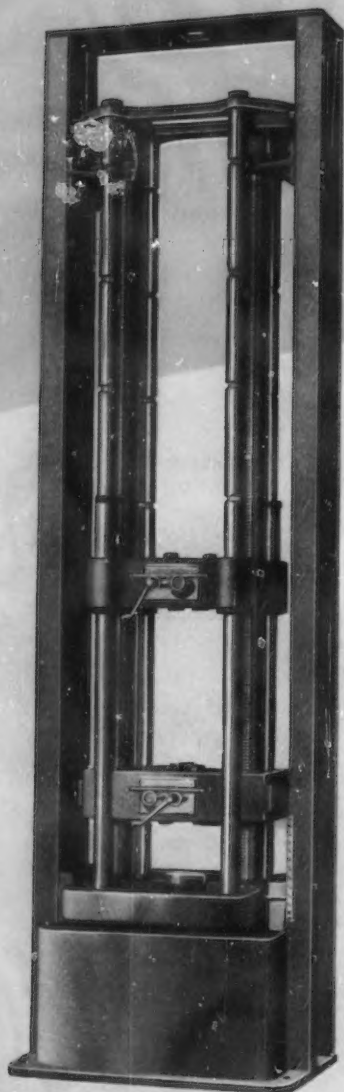
No. 107

HYDRAULIC AND MECHANICALLY DRIVEN

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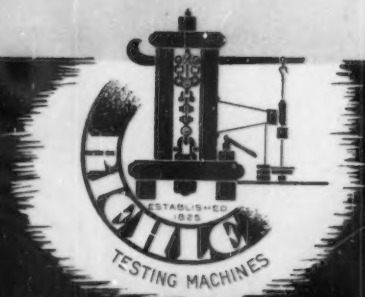


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Number 107

December, 1940

Two Technical Symposiums to Feature A.S.T.M. Spring Meeting in Washington

Sessions on Color and Particle Size Measurement Scheduled for Week of March 3-7

TWO EXTENSIVE symposiums, each of which should be of widespread interest to members of the Society and others concerned with the field of engineering materials, are to be technical features of the 1941 A.S.T.M. Spring Meeting scheduled for The Mayflower, Washington, D. C., on Wednesday, March 5. This meeting will be held during A.S.T.M. Committee Week which extends from Monday, March 3, through Friday, March 7.

A local committee on arrangements has been appointed headed by Vice-President G. E. F. Lundell, Chief, Chemistry Division, National Bureau of Standards, the personnel consisting of the following:

G. E. F. Lundell, *Chairman*.

H. S. Rawdon, *Secretary*, Chief, Division of Metallurgy, National Bureau of Standards.

T. I. Coe, Technical Secretary, Department of Technical Services, American Institute of Architects.

W. E. Emley, Chief, Division of Fibrous and Organic Materials, National Bureau of Standards.

A. C. Fieldner, Chief, Technologic Branch, U. S. Bureau of Mines.

H. A. Gardner, Chemical Engineer, The Institute of Paint and Varnish Research.

F. H. Jackson, Senior Engineer of Tests, Public Roads Administration, Federal Works Agency.

G. F. Jenks, Colonel, Ordnance Dept., U. S. Army.

Stanton Walker, Director of Engineering, National Sand and Gravel Assn.

In addition to this group, other active members in the Washington area may be called upon to assist in connection with the meeting.

There will be made available during the week complete information on places of interest and events, and there will also be information covering places of interest for ladies and the members' families. Some information of this kind will probably be transmitted to the members, either through the January BULLETIN, or a special mailing in February. This mailing will include a complete program of committee meetings and supplements the separate notices which each participating committee sends out.

SYMPOSIUM ON COLOR

In recent years the Inter-Society Color Council, of which A.S.T.M. is a member body because of the interest of a number of its standing committees in color, has used the occasion of national meetings of its member bodies to hold its meetings or to sponsor technical discussions. The Symposium on Color and Its Use in Evaluating the Appearance of Materials, which is to be an important technical feature of the Spring Meeting, is an outgrowth of this policy and consequently is sponsored jointly by the I.S.C.C. and the A.S.T.M. with the committee in charge consisting of representatives of these two groups headed by M. Rea Paul, Director, Technical Paint and Color Service, National Lead Co., former chairman of the Color Council and very active in its work and also secretary of A.S.T.M. Committee D-1 on Paint, Varnish, Lacquer, and Related Products. The committee in charge of the symposium is as follows:

A. G. Ashcroft, Product Engineer, Alexander Smith and Sons Carpet Co.

W. E. Emley, Chief, Division of Fibrous and Organic Materials, National Bureau of Standards.

C. E. Foss, Research Laboratories, Interchemical Corp.

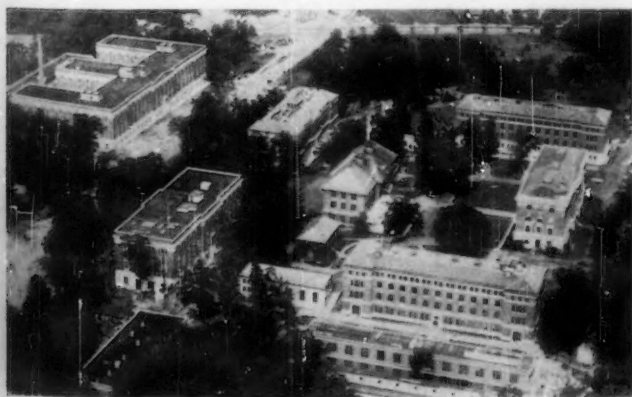
W. R. Fuller, Technical Director, Grand Rapids Varnish Corp.

H. A. Gardner, Chemical Engineer, The Institute of Paint and Varnish Research.

D. B. Judd, Physicist, National Bureau of Standards.

R. S. Hunter, Junior Physicist, National Bureau of Standards.

A. W. Kenney, Experimental Station, E. I. du Pont de Nemours & Co., Inc.



National Bureau of Standards

Paul Rapp, Associate Chemist, Public Roads Administration, Federal Works Agency.

W. M. Scott, Chief, Cotton Chemical Finishing Division, U. S. Bureau of Agricultural Chemistry and Engineering, Southern Regional Research Laboratory.

While work on color is of particular interest to certain A.S.T.M. committees including the following: D-1 on Paint, Varnish, Lacquer, and Related Products, D-2 on Petroleum Products and Lubricants, D-13 on Textile Materials, and D-12 on Soaps and Other Detergents, among others, the interest is not confined to these fields and this subject consequently is of interest to a broad cross-section of A.S.T.M. members and committee members.

Probably the best way to give an advance picture of the color symposium is to list the technical papers, and the authors. Accordingly, this list follows:

Introduction to Color—Deane B. Judd, Physicist, National Bureau of Standards.

Color Specification of Transparent Materials—Francis Scofield, Chemist, National Paint, Varnish, and Lacquer Assn., Inc.

Hiding Power and Opacity—R. H. Sawyer, Krebs Pigment and Color Corp.

Color Standards for Opaque Materials—I. H. Godlove, E. I. du Pont de Nemours & Co.

The Spectrophotometer in Testing the Color of Materials—A. E. Parker, Electrical Testing Laboratories.

Photoelectric Colorimetry—R. S. Hunter, Junior Physicist, National Bureau of Standards.

It will be noted that those preparing the papers are outstanding authorities.

In connection with this symposium, it is planned to publish in the January BULLETIN a general statement on the scope and purpose of the symposium with comments on the several papers which will be given. A few copies of the complete papers will be made available which will be used for the purpose of arranging for prepared discussions.

All who are interested in color as it pertains to materials should plan to attend this symposium which promises to be very interesting and worth while.

SYMPOSIUM ON NEW METHODS FOR PARTICLE SIZE MEASUREMENT

With respect to the interest of Society members in the Symposium on New Methods for Sub-Sieve Particle Size Measurement, the situation is almost exactly parallel to that for the Symposium on Color: namely, a widespread interest on the part of a great many members and committee members. Here again specific groups are particularly interested—those concerned with paint, varnish, lacquer, and related materials, cement, coal and coke, and others.

A number of very interesting discussions and technical sessions on the subject of fineness and test methods have been held at Society meetings. One group under the auspices of Committee E-1 is specifically concerned with the problem of particle size measurements, namely, Technical Committee III on Particle Size and Shape which is headed by L. T. Work, Director of Research, Metal and Thermit Corp. It is a section of this group which is responsible for the symposium featuring the Spring Meeting. This is the Section on Pigment-Type Materials which is headed by

C. E. Barnett, New Jersey Zinc Co. Mr. Barnett has been primarily responsible for the development of the symposium.

To convey well in advance an idea of the topics being discussed and those who will participate in the symposium, the following list is given but some changes may be made in final titles of the papers:

Gas Adsorption—Prof. P. H. Emmett, Johns Hopkins University.

Liquid Adsorption—Prof. W. W. Ewing, Lehigh University.

Centrifugal Methods—Dr. Martin, National Lead Co.

Wave Length Turbidimetry—Prof. A. H. Pfund, Johns Hopkins University.

Permeability—Prof. P. C. Carman, University of Cape Town (to be presented by some American technologist).

Correlation of Particle Size Measurements—L. T. Work, Metal and Thermit Corp.; and Herbert Schweyer, Columbia University.

The Electron Microscope—James Hillier, RCA Laboratories.

Those responsible for the symposium wish to stress the fact that it will deal primarily with new methods or new adaptations of older basic procedures. The papers will probably cover a size range from submicroscopic to cement.

COMMITTEE WEEK

As indicated above, the 1941 group meetings of A.S.T.M. committees will be held from Monday, March 3, through Friday, March 7. Many of the committees of the Society have already indicated their decision to hold sessions at this time and others will undoubtedly take part. A list of committees which plan to meet will be included in the January BULLETIN and each committee member will of course receive notice well in advance concerning meetings of the respective groups with which he may be affiliated.

Work will be started in January on the development of a schedule of meetings to avoid conflicting meetings. Considerable effort and time are expended in this study so that the number of conflicts committee members have are kept to a minimum. With so many meetings (in Detroit last year there were 110) a very rigid schedule is frequently necessary but it is considered that the main purpose of Committee Week is still maintained, namely, to permit hundreds of members of different committees to attend in one concentrated period of a few days, meetings of several different groups, thus conserving time and expenses and permitting some members to attend meetings who would otherwise not be able to attend if the meetings were held singly.



Jefferson Memorial

A.S.T.M. and the National Defense Program

A Statement by the Secretary-Treasurer

IN RECENT MONTHS the National Defense Program has thrown the spotlight of public attention upon the plans for production of armament and other materiel necessary to the national defense and for the most effective utilization of facilities, personnel and materials to that end. The magnitude of the procurement problems involved has been apparent from the beginning and is reflected in the activities of the National Advisory Defense Commission, especially its Raw Materials and Production Divisions, the Office of Coordinator of National Defense Purchases and, more recently, the Administrator of Priorities. An essential element of procurement of a product or material is an adequate specification describing the desired quality, properties, and performance characteristics and based upon definitive tests; and it is with this phase of the Defense Program as related to engineering materials that our Society is most concerned and can be of most assistance.

Our Nation engages upon the Defense Program far better prepared with respect to specifications than ever before. In the two decades that have passed since the end of the World War, research in industry, in Government and in educational institutions and research foundations has brought forth a vast fund of knowledge concerning materials and methods of determining their properties and evaluating their service characteristics. This knowledge has been systematically assembled and codified into the useful form of methods of testing and specifications. By providing a forum for cooperation of industry—both producer and consumer—Government and the educational and “general interest” groups, our Society has been able to formulate “standard” A.S.T.M. methods and specifications that represent accepted industrial practice in the production and utilization of the materials covered. In 1917 there were 133 A.S.T.M. specifications, methods, and definitions; now there are 952, an increase of some seven fold, which is one measure of the progress that has been made in this work.

In this same period, the Government has greatly improved the basis of its vast purchases by establishing the system of Federal specifications and coordinating the purchase requirements of the various Government departments through the activities of the Federal Specifications Executive Committee and the Procurement Division, Treasury Department. There are now over 1300 Federal specifications in addition to the hundreds of specifications of the Army and Navy covering materials primarily for military purposes. Thus the Government is well prepared with specifications upon which to base the procurement of defense materiel.

For the purpose of this discussion, such materiel falls into two groups: *first*, special materiel, usually of a strictly military character, having usually no close counterpart among industrial products, and for which special requirements specified by the armed services are paramount and must govern; *second*, materiel of a more gen-

eral nature, substantially equivalent to or perhaps exactly paralleled by industrial goods in commercial production for which the requirements of good commercial practice should usually be satisfactory. It is with respect to the second group that A.S.T.M. standards will be of greatest value in the procurement of these materials in the quantities that will be required in the Defense Program, having in mind the importance of both quality and speed of production with minimum disturbance of normal industrial operations in the interest of our whole economy. Clearly this goal is easier of attainment if Government purchases are made on specifications that are in substantial conformity as to essential requirements with specifications such as those of A.S.T.M. to which industrial production is already geared.

How Can A.S.T.M. Aid?

The Society can most effectively contribute to the National Defense Program along four broad lines of endeavor.

First, the continued development of specifications and methods of test. This is obviously of first importance and the standardization work of the Society (with its supporting research) will be vigorously carried on, with particular emphasis upon those materials and products that from time to time assume importance in national defense. Specifications will be kept up to date and abreast of the latest developments. Publications containing standards will be issued as expeditiously as possible and brought directly to the attention of those both in industry and in Government who are responsible for production and procurement of materials. The latter phase is largely provided for through the widespread membership of the Society and the general distribution of the Society's publications, supplemented by the contacts that are being established with the appropriate specification groups in the Federal Government.

Second, continued emphasis on research in materials. This is scarcely less important than standardization itself, since research provides the knowledge required for the efficient utilization of materials and at the same time produces the factual information needed to write useful specifications. There are over 100 research projects being carried on by the Society; many of these are intended to furnish data essential to the preparation of an A.S.T.M. method of test or specification, while others much broader in scope are designed to provide knowledge that will make possible the most effective adaptation of materials in all types of equipment and structures. Clearly it is essential that this work too shall continue to go forward.

Research sponsored by A.S.T.M. is essentially of a co-operative nature. Projects are planned under committee auspices by various groups having a common interest in acquiring certain information and are carried out in ways that frequently involve the pooling of facilities of several

research agencies, such as industry and Government laboratories, research foundations, and universities. Thus the Society brings to bear upon its research problems unusual talent and facilities. It is suggested that this co-operative approach to research might more frequently be used advantageously by Government departments to augment their own laboratory studies, especially in matters involving the working out of production methods and determining specification limits.

Third, the fuller utilization of the A.S.T.M. committee organization. The Society's committee organization can be a real aid at this time, comprising as it does some 60 committees with a membership of over 3500 individuals and companies, representing producing and consuming interests (including Government representatives) well informed collectively on all phases of production and use of materials, with expert knowledge of testing, specification and inspection problems, accustomed to working with one another in arriving at acceptable standards of quality and performance; and finally, prepared to cooperate to the fullest possible extent with the Government and industry in the present emergency. The services of the Society and its committees have been offered to the National Advisory Defense Commission, as well as to departments of the Government directly concerned with specification and procurement problems.

Some committees are already engaged upon specific problems at the request of branches of the Government service, such as a standard micrograph for 0.055-mm. grain size for copper alloys, a bend test for primer brass, the mercurous-nitrate (accelerated corrosion) test for copper-base alloys, and specifications for low-alloy steels suitable for welding. Specifications for cartridge brass and related cartridge materials were developed this year by Committee B-5 on Copper and Copper Alloys working in close cooperation with the Army Ordnance Department, and their publication this fall as tentative A.S.T.M. standards will, we are advised, be of considerable value in the procurement of these important ordnance materials. There will doubtless arise in the course of the Defense Program specific subjects upon which the committees of the Society might be helpfully engaged and the several Government services are invited to use the Society in this way.

It seems clear that Federal specification-writing activities will increase considerably as an outcome of stepped-up requirements for defense materiel. These activities will comprise new specifications, the revision of existing specifications and frequently, in the interest of economy and facilitating procurement, the harmonizing of requirements of two or more specifications covering materials for substantially the same purpose. With respect to military materiel, this work will largely originate in the responsible Army and Navy bureaus and departments and be coordinated through the Army-Navy Munitions Board and the Joint Army-Navy Aeronautical Board. General specification activities are expected to be concentrated in the committees of the Federal Specifications Executive Committee, whose work will probably have to be expanded to meet the present exigencies and provide for the correlation of Federal specifications and those of the Army and Navy where desirable.

Wherever there are comparable A.S.T.M. specifications

—and this is frequently the case—the knowledge and services of our committees can be used to bring about closer coordination of A.S.T.M. and Federal specification work. It is in this connection that the coordination already effected through membership of Government departments and individuals connected therewith on A.S.T.M. committees and through joint activities with such groups as the National Bureau of Standards, Bureau of Mines, Public Roads Administration, Forest Products Laboratory, and various bureaus of the Army and Navy will be most helpful. More direct cooperation is desirable, however, particularly in the early stages of specification writing. Through such cooperation it will be possible (1) greatly to facilitate inclusion of requirements in A.S.T.M. specifications to cover the needs of Government procurement, (2) to inform Federal specification committees of considerations underlying present requirements in A.S.T.M. specifications and of the status of new specification work in progress, and (3) in general to make available to them the wealth of information and data on specifications and tests in the hands of A.S.T.M. committees.

Methods of coordination along general as well as specific lines are being discussed with the appropriate Government authorities, with particular reference to urgent specification work related to the Defense Program.

The Society will continue to receive and comment upon drafts of Federal specifications in accordance with customary procedure and will expedite this work in the committees to whom the drafts are referred in so far as possible under the stress of present industrial conditions.

A further effective means of utilizing the committee organization of the Society is through active participation of official representatives of the Government departments in the deliberations of the committees. In this way developments in industry and technology affecting production, properties and specifications for materials as revealed in A.S.T.M. committee work are made directly and promptly available to Government specification authorities. As previously mentioned there are many such representatives now serving on these committees and the Society welcomes the extension of this practice.

Fourth, aid in personnel matters. As need arises for expert personnel required in the full development of the Defense Program, our Society can advise authoritatively in the field of materials. We have already advised with the Ordnance Department in the prospective formation of Special Ordnance Advisory Committees on Paints, Varnishes, and Related Products, and on Petroleum Products and Lubricants. Cooperation with the National Resources Planning Board in the development of the National Roster of Scientific and Specialized Personnel as it applies to "Testing of Materials and Materials Technology" was announced in the October issue of the ASTM BULLETIN. The Society is fully prepared to lend its facilities and services in all such personnel work.

Cooperation of A.S.T.M. in the National Defense Program can well proceed along the broad lines here described. Details must of necessity be worked out as the procurement plans of the Government and the concomitant specification activities develop. The knowledge, experience, and services of the committees, officers and staff of the Society, and of its membership generally, are available for the fullest use in advancing the National Defense Program.

Soaps and Other Detergents

By H. P. Trevithick¹

BY "SOAPS AND OTHER DETERGENTS" is meant those materials that are used for cleaning purposes where the cleaner is used in a liquid medium. These include not only soaps, as such, in all their infinite varieties and forms, but also the caustic lyes, the alkali carbonates, silicates, borates and phosphates, and also a large group of commodities such as sulfonated or soluble oils, sulfated alcohols, etc. It further includes the soaps and other detergents used in dry cleaning and the "pickling" acid liquors used in cleaning steel plates, etc., before tinning or enameling.

WIDE RANGE OF MATERIALS

The field thus covered by the Society's Committee D-12 on Soaps and Other Detergents includes not only supplies for ordinary laundry purposes, but also materials suitable for hospital uses, where the antiseptic qualities of soaps are also of interest. In addition, the cleaning of all types of building surfaces and of all types of transportation equipment is of direct concern to this committee. In such a comparatively simple operation as washing dishes, there is a tremendous difference between the material required by the housewife for a few dishes, considering very seriously the effect of the cleansing material on the hands, and that required by large hotels and restaurants, where power washers are used, and the hands do not come in contact with the cleanser.

In manufacturing textiles, many washing operations are used, from "boiling off" the silk or "scouring" the wool, to the final cleansing of the finished material.

In metal finishing, scale must be completely removed from plates and other metallic sheets, before painting, enameling, or other finishing can be applied.

WHAT A.S.T.M. IS DOING

In 1934, after the Society had received many requests for specifications from laundry owners' associations, hospitals, railroads, and many others, the A.S.T.M. studied the question of drawing up such standards and authorized the study of the need of such a program.

In 1936, after studying this problem for 2 yr., Committee D-12 on Soaps and Other Detergents was organized at the annual meeting at Atlantic City. The personnel of this committee consists of representatives of the National Bureau of Standards and other Government departments, leading producers and many consumers of soaps and alkali detergents, and national authorities on the general subject of detergency. Advice and assistance have been obtained from many dependable sources not directly listed as members of the committee.

The American Oil Chemists Society is officially represented on the committee and the extensive work carried out by that organization has been very helpful in fur-

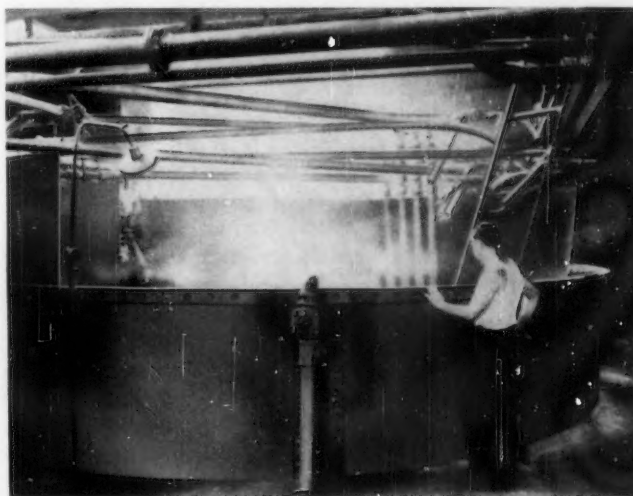
thering the work of Committee D-12, particularly in the establishment of methods of chemical analyses.

The committee holds meetings twice a year, fall and spring, all of these meetings, so far, having been held in New York City.

It has presented to the Society in a relatively short time a number of specifications for soaps and other detergents as well as methods of analyses of soap, soap products, of special detergents, and of sulfonated and sulfated oils, together with definitions relating to the terms used.

WHAT ARE SOAPS?

At this time, it seems desirable to discuss soaps and other detergents, their methods of manufacture and use, with the idea of acquainting the A.S.T.M. membership with our specifications and methods in order that these standards will be used more generally.



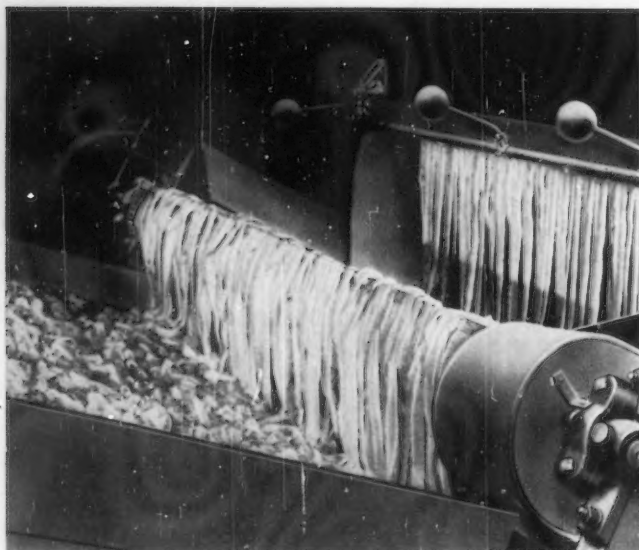
Soap Kettle—This huge kettle is charged with one quarter million pounds of Olive, Palm, and Coconut Oils. This blend of vegetable oils is boiled with caustic soda to form soap and glycerin.

Soaps are the products formed by saponifications or neutralization of *fats, oils, waxes, rosins, or their acids* with organic or inorganic basis.

Fats and oils are compounds of fatty acids and glycerin, which contain 10 to 13 per cent of glycerin and 90 to 87 per cent of fatty anhydrides. *Fats* are those which are solid at ordinary temperatures and *oils* are liquid at the same temperatures. Theoretically, the glycerin and fatty acids are chemically combined into neutral fats, usually triglycerides, but actually there is more or less decomposition, due to many causes. In this decomposition, the fats are separated into two component parts—free fatty acids and lower glycerides such as diglycerides, and monoglycerides, with some free glycerin which remains dissolved in the fat. The fatty acids remain in the fat as free fatty acids, and their amount varies from a fraction of 1 per cent to 100 per cent, but usually runs several per cent.

NOTE.—DISCUSSION OF THIS PAPER IS INVITED, either for publication or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia, Pa.

¹ Chairman of Committee D-12 on Soaps and Other Detergents; Chief Chemist, New York Produce Exchange, New York, N. Y.



Cooling Roll of Soap Dryer—Hot soap from kettle is passed over cooling roll where it is congealed and scraped from roll in thin ribbons. Ribbons then enter drying chamber at approximately 30 per cent moisture.

Waxes are compounds of fatty acids and some alcohol, like cetyl alcohol.

Rosin or colophony is the resin remaining after distilling turpentine. It is a compound of abietic acid, and hydrocarbons.

All of the above materials are suitable to be used in their original form for the manufacture of soap, or they can be changed into their fatty acids, as, for instance, by the Twitchell process, and the fatty acids alone used for soap.

"Bases" are organic or inorganic. Any metallic hydroxide will make "soap" with fatty acids, but most of them are insoluble in water. The bases usually used in soap making are the ones making water-soluble soaps. Of most importance are sodium hydroxide which makes the normal or hard soaps, and potassium hydroxide which makes soft soaps. The carbonates of these two metals can also be used—usually with fatty acids, although they can be used with some oils.

Soaps formed by the alkaline earths, lime and magnesia, are water insoluble and form the familiar scum on "hard" water when soda soaps are used.

The heavy metals form soaps which are used for a variety of purposes. Aluminum soaps are used in polishing materials, in inks and paints, and for waterproofing textiles. This soap, together with magnesium, zinc, lead, and other metallic soaps are used for thickening lubricating oils. Zinc stearate is used extensively in face powders.

Ammonia, ethanolamine and triethanolamine soaps are used extensively as dry-cleaning soaps and in textile soaps, cosmetics, etc. They are excellent emulsifiers for oils, waxes, etc.

USES

The uses of soap are very varied. Its first use is in the home as toilet and laundry soaps, and in power laundries. It is also used industrially in many ways. The textile in-

dustry uses it for scouring, boiling off, fulling, etc. It is used in insecticides to dilute the solution and to make the insecticide adhere to the plants. It is used in cosmetics, tooth paste, creams, shampoos, and emulsions. It is also used in wire drawing, in the manufacture of cup greases and lubricants, etc. Altogether over 3,000,000,000 lb. are produced in the United States alone.

The other "wetting agents" are colloidal clays, sulfonated oils, and sulfated alcohols. These last, in particular, form soluble compounds with lime and magnesia, and so do not form objectionable products in hard waters. Further, much smaller amounts of these quantities are required to produce the desired wetting than would be the case with soap, but they are more expensive to manufacture.

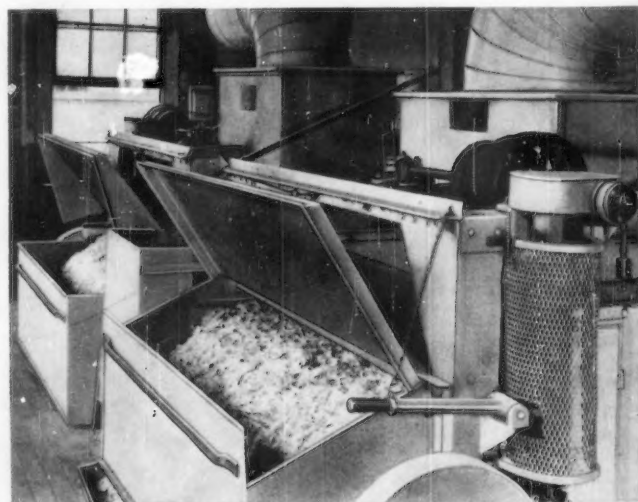
MANUFACTURE

There are three general methods of making soaps, the hot or boiled process, the semiboiled, and the cold process.

Hot Process:

In the hot method of manufacture, the fat and lye are placed in the kettle and saponified by heat, usually supplied by steam in open or closed coils or both. The process of saponification takes a number of days to complete and the lye is added in two portions, giving the "killing" and "strengthening" change. Care must be taken, or the mass will boil over. After saponification is finished, the soap is salted out by adding salt to the soap mass, whereupon the soap itself, being insoluble in salt water, floats on the brine, and the glycerin, excess alkali, dirt, and other impurities collect in the brine. This brine liquor is then drawn off and the soap is washed by reboiling with lye, salt water, etc., until it is clean, several washings usually being necessary. This soap usually contains 35 per cent of water.

If rosin soap is to be made, the rosin is usually saponified separately in another kettle and then added to the soap kettle after the fat saponification process is finished.



Discharge End of Soap Dryer—Ribbons have been broken into chip form and moisture reduced to approximately 14 per cent.

The further processes depend upon the nature of the raw stock used and the finished products desired. Rosin soaps are usually used for laundry purposes only and in that case are usually poured out into wooden or steel frames, holding 400 to 1200 lb., and allowed to chill. When hard, the frames are stripped off, and the block of soap is cut by wires into slabs. These slabs in turn are wire cut into bars or cakes. These can be stamped with the brand or other marks and then wrapped by the wrapping machines.

In manufacturing toilet soaps, the melted soap from the kettle, or from remelting of the large blocks, is placed in the crutcher, a mixing machine, in which perfume, colors, and other ingredients can be added. It is then made into chips and dried to a content of 10 to 15 per cent of water. These chips then go to the milling machine which is a set of rollers through which they pass and are scraped from the last roller into the milling box as a fine ribbon. This milling gives a glossy smooth finish. It is then extruded from the plodder by a worm screw in the form of a ribbon the size and shape of the final cakes to be made. After this ribbon chills slightly, it is cut off into cakes which are pressed, stamped, and wrapped.

There are two methods used in manufacturing chip soap. In one the melted soap is allowed to flow onto large hollow rolls, chilled with brine, from which the chips are scraped off onto a belt. This belt is carried through a drying machine where the chips are dried in hot air, and either packed or processed for further use.

The other method of making chips is to chip slabs or bars, cut from the larger blocks. Chips made by this method are usually not so fine and thin as the others.

The so-called bead soaps are made by blowing hot liquid soap in a fine stream into a vacuum tower where the sudden expansion and cooling form the beads. They fall to the bottom of the tower and are removed by a rotating cylinder (divided into four segments to hold the vacuum).

Cold Process:

In the cold process of manufacturing soap, the hot fat and lye are thoroughly mixed and then poured into frames and allowed to stand until saponification is almost complete—a rather long period of time. No glycerin is recovered in this process, the glycerin remaining in the soap.

Semiboiled Process:

In the semiboiled process, a combination of the two methods (hot and cold) is used.

In the manufacture of soap powders, the cheaper grades of soaps are ground to a powder and mixed with one or more builders, usually soda ash, but sometimes including silicates and other builders.

Boiled-down soaps are usually reasonably free from both excess alkali and excess fat. Excess alkali tends to be harsh on the hands. As the soap ages, the alkali turns to carbonate and makes the soap appear spotted. It should be less than 0.5 per cent in all soaps and frequently runs under 0.1 per cent. Excess fat tends to make the soap turn rancid faster, although it is added in certain soaps because the fat has a softening effect upon the skin.

The lower grade soaps usually have more free alkali, as this excess aids in the removal of dirt.

Washing powder consists of 15 per cent soap and the balance soda ash (sodium carbonate) and water. As the soap is valued at ten times the value of the soda ash, the committee has specified this minimum of 15 per cent of soap in washing powder.

Lower grade powders have a place for very rough cleaning, etc., but, to obviate confusion, we have called them soapy alkaline detergents. These contain 2 to 15 per cent of soap, the price varying with the amount of soap present.

CLASSIFICATION

Soaps and other detergents can be classified as shown in the following table. This table is not complete but will furnish an idea of the forms in which these products reach the market, for many of which Committee D-12 has prepared or is preparing standard specifications.

SOAP AND ALKALI TYPES

SOAP AND ALKALI TYPES	
<i>Industrial Bulk Soaps</i>	<i>Miscellaneous</i>
Solid	Liquid (Floor)
Bar	Paste Potash Soaps
Flake	
Granulated, Powdered, Bead,	<i>Synthetic Detergents</i>
Special Forms	Paste
Built	Flakes
Soap Powder	Powdered, Granulated, or Beads
Scouring Powder or Cleanser	Liquid
<i>Toilet Soaps</i>	<i>Alkalis</i>
Milled Toilet Soap	Borax
Floating Soap	Sodium Carbonate
Hard Water Coco	Sodium Bicarbonate
Pumice	Modified Soda
Liquid	Sodium Silicates (various ratios)
Bead, Granulated, or Powdered	Meta
	Sesqui
	Ortho
	Sodium Phosphates
	Tri Sodium
	Tetra Pyro
	Caustic Soda
	Specialty Mixtures

In most instances—and I believe the same holds true for the products of other industries—the development of an actual tangible product precedes the development of a specification for that product. Of course, before the specification can be written it is necessary to make chemical and physical tests to determine the characteristics of the product and to lay the foundation for the specifications. For that reason, it is highly essential for anyone working with, or interpreting specifications, to have a knowledge of the chemical characteristics or chemical analysis and the physical properties or physical examination of the product or products under consideration. A typical form for reporting the analysis of a sample of soap is shown on the next page.

To interpret analyses and specifications, it is necessary to have some knowledge of the chemical terms applying to the analyses of soaps and soap products. The meaning of the terms appearing on a typical analysis form are accordingly reviewed and explained:

A Moisture and Volatile Matter, as received, at ———C.———%:

Water or any other matter that evaporates at a temperature slightly over the boiling point of water, in this case 105 C., is included under "Moisture and Volatile Matter."

LABORATORY REPORT			
No. _____		Date _____	
Sample submitted as: _____			
Mfd. by _____			
Submitted by _____			
Moist. & Vol. Matter as recd. at _____		Dry Basis _____	At _____ Water _____
Anhydrous Soap Content (Real Soap) _____			
Sodium Silicate (Ratio 1:—) _____			
Sodium Carbonate _____			
Other Alkali Salts _____			
Free Caustic Alkali (Na ₂ O) Salt _____			
Glycerin _____			
Free Fat _____			
Unsaponifiable Matter _____			
Total _____			
Total Alkali (Na ₂ O) _____			
Combined Alkali (Na ₂ O) _____			
Total Fatty Acids _____			
Insoluble in Alcohol _____			
Insoluble in Water _____			
Total SiO ₂ _____			
Titer _____		Sap. Value (% KOH) _____	
Iodine Val. (Wijs) (% Iod.) _____		_____	
% Rosin in Mixed Soap Acids _____		_____	
Wt. as Recd. _____		Color _____	Odor _____
Fats Used _____		_____	
Remarks _____		Chemist _____	

Water is used to dissolve some of the raw materials, such as caustic soda or carbonate alkali, used in the manufacture of soaps. It is present in soap in quantities varying from 2 to 50 per cent depending upon the type of soap being made. Ordinary chip soap, after finishing in the kettle but before being chipped and dried, contains in the neighborhood of 30 per cent of water or moisture. This moisture or water content can be reduced to 5 or 6 per cent by various drying methods.

In the case of liquid soap, any alcohol which might be present would be classified as volatile matter and included under this same heading.

In the ordinary determination of moisture, small amounts of glycerin and some types of fatty acids are also volatilized and would be included in the determination. This figure would approximate only 1/2 per cent or less.

B Anhydrous Soap Content (Real Soap):

This represents the sum of the combined alkali, calculated to sodium oxide (Na₂O), and the fatty anhydrides. (See notes on combined fatty acids.) It represents a theoretical 100 per cent pure soap and should not be confused or compared with a rough estimate of commercial character. This figure is also an index of the true soap value of the product in question.

C Sodium Silicate (Ratio 1:—):

Soda combines with silica to form sodium silicate, in a number of ratios, that is, 1 part of soda will combine with as many as 4 parts of silica to form commercial grades of the product.

Sodium silicate added to soap in proper quantities increases the detergent action of soap and acts as a water softener.

D Sodium Carbonate:

During the course of soap manufacture, the alkali used is exposed to the air. Small amounts of caustic soda or potash are changed to the corresponding carbonates as a result of contact with the carbon dioxide in the air. The alkalis used also contain small quantities of the corresponding carbonates as impurities. As a result all finished soaps, unless specially treated, contain carbonates in small quantities varying from 0.2 to 0.8 per cent. Amounts in excess of 1 to 1 1/2 per cent can be considered added and not inherent to the process of manufacture.

E Other Alkali Salts:

"Builder," "alkali detergents," and "water softeners" are some of the names used to describe chemicals other than soap which may be present

in the product in question. "Other Alkali Salts" vary much in the percentage present and may be made up of such things as trisodium phosphate, borax, etc.

With the facilities of a modern laboratory, these things are easily detected. Few manufacturers deliberately add them to cheapen the product with the idea of fooling the consumer. They are added to soap and soap products as "builders" or detergents and the product is sold on the particular basis which results from their addition. They are soluble compounds and have, in combination with soaps, detergent properties which cannot be denied. Starches, insoluble silicates, etc., when incorporated in large amounts are more or less deliberate attempts at adulteration, except in cases of grit or abrasive hand soap or scouring mixtures. In these, the insoluble matter is added for its abrasive action.

F Preservative:

Pure soaps, under some conditions of storage, are affected by temperature and humidity, in so far as their keeping qualities are concerned.

Small amounts of soda ash and sodium silicate are sometimes added (1 or 2 per cent) to improve the keeping qualities of pure soap, to act as a preservative. The substances added have detergent value, the percentages used are small, and the practice is considered ethical and followed by the majority of manufacturers.

G Free Caustic Alkali (Na₂O):

Free caustic alkali may be present in the form of caustic soda or caustic potash, depending on the type of soap in question. These alkalis are used to saponify the fat stocks, and in the early stages of manufacture are present in quantities in excess of the amount required. By proper control in the finishing operation, the free caustic alkali is reduced, in most cases, to less than 0.20 per cent. Its presence in quantities greater than this are an indication of either deliberate addition of the alkali or lack of control in the manufacturing process.

The Na₂O content means simply that the free caustic alkali has been calculated to the sodium oxide instead of sodium hydroxide. As sodium oxide it can be included directly with the balance of the figures to total 100 per cent.

H Salt (Sodium Chloride):

Salt appears as an impurity in the alkali used in soap making. Its presence here is so small, however, as to be negligible. In boiled soap, however, salt is used as a means of graining or salting out the impurities, excess alkalis, etc., in the saponifying and finishing process. It is economically impossible to remove the last traces of salt from commercial boiled soap, so it appears in the finished soap in quantities up to 1 per cent. While it has no detergent action, in these small percentages it has no appreciable effect upon the detergent value of the soap.

I Glycerin:

The fats and oils used in making soap are chemical combinations of glycerin and fatty acids (glycerides). During the course of manufacture the oils and fats are separated into their constituents of glycerin and fatty acids. The fatty acids combine with the alkali (in the form of caustic soda or the corresponding potash salts) to form soap, and the glycerin separates in the free state along with any impurities. In boiled soap the glycerin is separated, in the changes of spent lye, by the salt used and is recovered and refined for sale. Soaps of the hard water coco type, classified as cold-made soaps, contain whatever glycerin is present in the original fat stock, as this manufacturing process does not permit its removal. In boiled soap it is economically impossible to remove the last traces of glycerin from the finished soap. Therefore, it appears in commercial soap in quantities up to 1 per cent as a maximum (in cold-made soaps this maximum is 6 per cent), and while it has no direct detergent value, its presence in these small quantities is not detrimental.

J Free Fat:

Free fat, in soap or soap products, is the result of incomplete saponification of the original fat stock or partial decomposition caused by age, usually under poor storage conditions. It has no detergent value and its

presence may be a detriment in that it sometimes causes the development of a bad odor in washed materials. There are, however, exceptions to this: some types of special soaps contain free fat or fatty acids, for example, saddle soap, some textile processing agents, and soaps of the hard water coco type.

K Unsaponifiable Matter:

Fats and oils, besides their major constituents, fatty acids and glycerin, contain small quantities of chemical bodies known as sterols, along with other substances which do not directly combine with the alkali used for saponifying and are not entirely removed in the manufacturing process. The percentages of these substances present vary with the type of fat stock used and in some cases will run up to 1.25 per cent.

L Total:

In some cases two totals are given, one on a dry basis in which all moisture is excluded, the other based on either the moisture content at which the sample was received or an arbitrary moisture content approximating the moisture content of the soap at the time of packing.

M Total Alkali (Na_2O):

The total alkali, usually given in terms of Na_2O (sodium oxide), is the sum of all the alkali present in the soap. Any "carbonate alkali" present, the "combined alkali," "free caustic alkali," "alkali present as trisodium phosphate" or "sodium silicate," are all included in this figure. (It does not include NaCl .)

N Combined Alkali (Na_2O):

Combined alkali is just what its name implies. It is the quantity of alkali (usually given in terms of sodium oxide, Na_2O) necessary to saponify the fatty acids present in the soap, and might be called "organically combined alkali."

O Soap Acid Anhydrides—Combined Fatty Anhydrides:

This is the fatty material actually combined with the above "combined alkali" to form the soap. This figure does not usually include any free fat which may be present in the soap. Theoretically, the sum of the "combined alkali" and "combined fatty acid" does not represent the true, total dry soap present. The explanation and calculations necessary are rather involved. Suffice it to say that a conversion factor is used, and multiplying the combined fatty acids by this factor, gives as a result the fatty anhydrides. These added to the combined alkali (as sodium oxide, Na_2O) yield the real, total dry soap.

Fatty Anhydrides represent approximately 97 per cent of the percentage of *fatty acids* present.

P Insoluble in Alcohol:

The determination of material insoluble in alcohol is a check on the percentage of material other than soap and moisture present. Sodium carbonate, trisodium phosphates, silicates, volcanic ash, etc., are insoluble in alcohol. Pure soap is soluble in alcohol. Materials found in laundry bar soap or built soaps are included under this heading.

Q Insoluble in Water:

Materials such as pumice—volcanic ash—and talc will be included in this figure, materials usually found in scouring cleansers and pumice soaps.

R Total SiO_2 (Silicon Dioxide):

In the determination of sodium silicate, the soap is so treated as to separate the silicate from it. Continued treatment results in the residue being changed to silicon dioxide which is accurately weighed. The percentage of sodium silicate present is calculated from this figure.

S Total CO_2 (Carbon Dioxide):

Sodium carbonate, present in varying amounts, when treated with acid gives off carbon dioxide. By determining the amount of carbon

dioxide present it is possible to calculate the percentage of carbonated material such as sodium carbonate present.

T Titer of Fatty Acids:

The titer test of the fatty acids of an oil or fat is closely related to the melting point of that fat. With few exceptions, the properties of a soap are influenced by the titer test of the fat stock used. In explanation of this, it is commonly agreed, for example, that a tallow soap of 42 titer will stand up under a higher temperature in a wash wheel than a low grade tallow or grease soaps, titer 38 to 39. Some of these properties are not, however, borne out by soaps of mixed fatty acids, particularly those containing palm oils in various percentages.

U Saponification Value (% KOH):

The saponification value of a fatty acid is an index of the amount of alkali which will combine with it to form soap. This figure is used in the laboratory as a means of identifying the fat stock used.

V Iodine Value (Wijs) (% of Iodine)

Iodine under certain conditions combines with fats and oils or fatty acid mixtures in definite quantities, depending upon the type of fat or oil. The determination of the iodine value of a fat or oil or fatty acid mixture is therefore a means of identifying the fatty material under examination.

W Percentage of Rosin in Mixed Soap Acids:

Rosin acids, or rosin, is used to replace varying quantities of fats and oils in laundry bar soaps. Rosin soaps are useful in soaps of this type for scrubbing, etc., as they increase the solubility and lathering properties. Some special soaps are made of rosin fatty acids without the addition of other fats.

X Weight as received—Color—Odor:

Tests and observations covering such characteristics as weight, color, and odor are sometimes indicative of the quality of the product.

Bar and package items are weighed as received by the laboratory.

Y Fats Used:

The titer test, saponification value, and iodine value of fatty acids are used as a means of determining the approximate percentage composition of the fat stocks and primarily concerns the laboratory.

The foregoing will assist in the interpretation of chemical analyses of soaps and soap products.

Perhaps it has been noted that the totals of many analyses are slightly over or under 100 per cent. This is not necessarily an indication of inaccuracies in the figures present. Figures should be presented in their original form rather than manipulated as is often done to round them off.

On the analysis forms referred to, two columns of figures are shown. One column on a dry basis includes figures calculated from the original analysis. The other column includes the figures on the basis of an average moisture content of the soap or soap product at the time of analysis.

By all means, when making comparisons, compare like figures. Compare them on a dry basis or on the same moisture basis. Never compare a set of figures on a given moisture basis with a set of figures on a dry basis.

In some soap-consuming industries, the titer test of the fatty acids obtained from soap is considered quite important in the valuation of that soap. Because the titer test has been given undue publicity, an explanation follows.

TITER TEST

The titer test is a specially developed test for use in identifying and evaluating fats and oils. Many times we

hear individuals speak of the titer test of a soap. Such a thing does not exist. The *titer test* refers specifically to the solidifying point of the fatty acids which are combined with the alkali to produce a particular soap.

This *misunderstanding* may be due to the fact that the *titer* of the fatty acids used to make soap, influences to a degree the properties and the specific applications of a soap.

To run the test, the fatty acids in a soap are set free by the addition of acid to the soap dissolved in water. The fatty acids are washed with water and dried preparatory to running the test.

Using a special thermometer in standard apparatus the titer of the fatty acids is determined.

STANDARDS

Committee D-12 has already established standard test procedures for a number of the determinations referred to above and based upon these has developed standard specifications covering a wide range of products as indicated in the accompanying list. The specifications themselves appear in the A.S.T.M. Book of Standards and it is suggested that reference be made to these specifications as an indication of the manner in which the various properties are covered. The Standard Specifications for Milled Toilet Soap (D 455 - 39)² would be considered typical.

The Committee also has under consideration the following proposed specifications and methods:

Proposed Specifications:

- Low Titer Soaps
- Detergent Soap Powder
- Red Oil Soap
- Liquid Soaps
- Grit Cake Soap
- Scouring Powders

Proposed Methods:

- Sampling and Analysis of Tetrasodium Pyrophosphate
- Sampling and Analysis of Sodium Orthosilicate

Where these standard specifications are used, it is certain that commercial items, that is, items of regular manufacture, will be purchased, and hence manufacturers can give the lowest prices, because of large production. Where special specifications are prepared and used, costs usually run much higher, due to changes in composition, special packing, low volume of production, etc. It frequently happens that special specifications require the manufacture of just enough product to fill the particular order, thus increasing the cost very materially.

All soaps tend to gain or lose moisture content on standing, and very frequently shipments show a considerable loss of weight upon arrival at destination. Buyers who are not familiar with this material are apt to draw erroneous conclusions (whereas actually the commodity has only dried out in transit and all the soap value shipped has been received) and have made deductions for loss in weight. To protect both buyer and seller, we have introduced a purchase clause and formula in the specifications to cover such changes in moisture content. This clause also prevents the buyer from charging for more weight than he actually shipped, regardless of the calculations from the formula.

² 1939 Book of A.S.T.M. Standards, Part III, p. 483.

One of the sections of Committee D-12 has concentrated all its work on types of detergents other than soap such as the carbonates, hydroxides, phosphates, and silicates of the alkalies. Another section has devoted its efforts to the sulfated and sulfonated detergents, etc. The committee has written specifications and methods of analysis for caustic soda, soda ash, modified soda, sodium metasilicate, sodium sesquisilicate and trisodium phosphate. Specifications and methods of analysis are at present in process of formulation for tetrasodium pyrophosphate and sodium orthosilicate.

Methods of testing the sulfated and sulfonated detergents have also been drawn up but specifications for these have not as yet been prepared although the committee has been studying this problem for 3 yr.

One of the subcommittees is considering the preparation of a monograph covering the types, properties, and uses of the alkali detergents and soaps and hopes to be in a position to issue such a pamphlet within the next year or two.

Specifications and Methods Developed by Committee D-12

Standard Specifications:

- D 455 - 39 Milled Toilet Soap
- D 456 - 39 Caustic Soda
- D 457 - 39 Modified Soda (Sesquicarbonate Type)
- D 458 - 39 Soda Ash
- D 496 - 39 Chip Soap
- D 497 - 39 Ordinary Bar Soap
- D 498 - 39 Powdered Soap (Nonalkaline Soap Powder)
- D 499 - 39 White Floating Toilet Soap

Tentative Specifications:

- D 533 - 39 T Built Soap, Powdered
- D 534 - 39 T Soap Power (Alkaline Soap Powder)
- D 535 - 40 T Palm Oil Solid Soap (Type A, Pure; Type B, Blended)
- D 536 - 39 T Palm Oil Chip Soap
- D 537 - 39 T Sodium Metasilicate
- D 538 - 39 T Trisodium Phosphate
- D 592 - 40 T Olive Oil Solid Soap (Type A, Pure; Type B, Blended)
- D 593 - 40 T Salt-Water Soap
- D 594 - 40 T Sodium Sesquisilicate
- D 595 - 40 T Tetrasodium Pyrophosphate (Anhydrous)

Standard Methods:

- D 460 - 39 Sampling and Chemical Analysis of Soaps and Soap Products
- D 501 - 39 Sampling and Chemical Analysis of Special Detergents
- D 502 - 39 Test for Particle Size of Soaps and Other Detergents

Tentative Methods:

- D 500 - 38 T Chemical Analysis of Sulfonated and Sulfated Oils
- D 501 - 40 T Sampling and Chemical Analysis of Special Detergents (Trisodium Phosphate, Sodium Metasilicate and Sodium Sesquisilicate, Carbon Dioxide in Caustic Soda)

Tentative Definitions:

- D 459 - 40 T Terms Relating to Soaps and Other Detergents

Phthalic Anhydride Determinations in Alkyd Resins

By John McE. Sanderson¹

EDITOR'S NOTE.—This paper describes certain of the methods used in the cooperative test program to develop a standardized method of test for phthalic anhydride content of alkyd resin solutions, the new method having been approved at the annual meeting on the recommendation of Committee D-1 on Paint, Varnish, Lacquer, and Related Products, and issued under the designation D 563 - 40 T.

MANUFACTURERS and users of paints have found by experience that synthetic resins made from phthalic anhydride impart certain desirable characteristics, notably a combination of quick drying and good adhesion coupled with excellent retention of gloss and color on prolonged exposure to the weather. The use of such resins is, therefore, being more and more generally specified in paints for a variety of uses.

The proportion of phthalic anhydride used in the preparation of the vehicle is, of course, only one of many factors which influence results obtained with the finished product. Final evaluation of the coating must be based on performance in the particular application for which it is used. However, to some extent the composition of the material can be used for preliminary guidance and selection, and for this purpose it is desirable to have available an accurate analytical method for determination of phthalic anhydride in such coatings. A group, with the author as chairman, was therefore appointed for this purpose by W. T. Pearce, Chairman of Subcommittee IX on Varnish of the Society's Committee D-1 on Paint, Varnish, Lacquer, and Related Products. The others who consented to cooperate in this work were:

Howard R. Moore, U. S. Navy Yard, Philadelphia, Pa.
E. F. Hickson, National Bureau of Standards, Washington, D. C.
L. A. Wetlaufer, E. I. du Pont de Nemours and Co., Philadelphia, Pa.
W. H. Lutz, Pratt & Lambert, Inc., Buffalo, New York.
J. V. Hunn, Sherwin-Williams Co., Chicago, Ill.

It was found that there was some difference of opinion as to the relative merits of the two methods in more or less general use by the paint industry for phthalic anhydride determination, namely, the Kappelmeyer and the Navy Methods. This group therefore undertook to determine whether one or both of these methods would give accurate and concordant results on various types of alkyd resins in the hands of different operators. Details of the two analytical methods used are as follows:

Solid Content of Solutions:

Weigh 1 g. sample into a tared cover in a half-pint varnish can. Rotate to distribute the solution uniformly over its entire inner surface. Dry in an oven at 105 C. for 3 hr. Cool and weigh. Report weight of the residue as percentage solids.

NOTE.—DISCUSSION OF THIS PAPER IS INVITED, either for publication or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia, Pa.

¹ Sales Engineer, American Cyanamid Co., New York, N. Y.

KAPPELMEYER METHOD FOR PHTHALIC ANHYDRIDE

(Modified from method as published in *Paint, Oil and Chemical Review*, June 10, 1937)

Weigh a quantity of the vehicle equivalent to 2 to 3 g. of solid content into a 500 ml. soil digestion flask, fitted with a ground glass air cooled reflux condenser 32 in. in length. Add 10 ml. of benzol and warm until a homogeneous mixture is obtained, and then add 150 ml. of 0.5N KOH in absolute alcohol. The alcohol may be denatured 2B grade, but must be absolute.

Warm on the steam bath for 1 hr. at 60 C. and then gently reflux for 3 hr. Cool, allow to stand for 1 hr. and wash down the sides of the flask with 50 ml. of absolute ether.

Filter at room temperature using a Gooch crucible with asbestos mat and wash the precipitate with 50 ml. of a mixture of equal parts of absolute alcohol and ether, using five 10 ml. portions. Do not allow air to suck through the crystals as they are strongly hygroscopic and may absorb water from the air. Dry for 10 min. in an oven heated to 60 C. and then to constant weight over sulfuric acid in an evacuated desiccator.

One gram of the precipitate, the potassium alcohol salt of phthalic acid, is equivalent to 0.5139 g. of phthalic anhydride.

NAVY DEPARTMENT METHOD FOR PHTHALIC ANHYDRIDE DETERMINATION

(From Naval Aircraft Specification ST-15c Revision of July 15, 1938)

C-30. Phthalic Anhydride Quantitative—The solid content of the vehicle is determined by the method described for percentage of non-volatile or volatile. An amount of vehicle representing 3 g. of solid content is weighed into a small vial. The vial is dropped into a 500 ml. Erlenmeyer and 50 ml. of 1:1 alcohol-benzol mixture is added and solution effected by heating, if necessary. Fifty ml. of normal potassium hydroxide solution are added and saponification accomplished by refluxing for 2 hr. Evaporate to dryness and take up in 100 ml. of water. Transfer to a separatory funnel and just acidify with 10 per cent acetic acid. Extract with several portions of ether, leaving the potassium acid phthalate in the aqueous layer. This aqueous layer is acidified with 10 per cent hydrochloric acid using Congo red paper as indicator whereby the phthalic acid is liberated. In case of a precipitate at this point, filter and wash several times with water to remove all traces of phthalic acid from the filter. The water portions are combined and transferred to a separatory funnel. The aqueous layer is then extracted with several portions of ether which removes the bulk of the phthalic acid. Although phthalic acid is only slightly more soluble in ether than in water, the equilibrium is displaced in favor of the ether by the presence of mineral salts in the aqueous layer. Nevertheless, it is difficult to extract the phthalic acid quantitatively in this way, and after the bulk of the acid has been removed as described above, the aqueous solution is evaporated to dryness on the edge of a hot plate, being careful to avoid overheating, and any remaining phthalic acid is dissolved out of the mineral salts with several portions of ether, each of which is boiled. The combined ether extracts are evaporated to recover the phthalic acid, which is dried at 65 C. on the edge of a hot plate for 4 hr. to remove traces of volatile acids which were used to hydrolyze the soaps. The acid is dissolved in alcohol, an excess of 0.2 N alkali added, the solution heated for 10 minutes and the excess alkali titrated with 0.2 N acid. The amount of phthalic anhydride is calculated from the alkali consumed.

$$\begin{aligned} & \text{ml. 0.2 N base added} - \text{ml. 0.2 N acid used} = \text{ml. 0.2 N base consumed} \\ & \text{ml. 0.2 N NaOH consumed} \times 0.0148 = \text{g. phthalic anhydride} \\ & \frac{\text{g. phthalic anhydride} \times 100}{\text{wt. of sample}} = \text{per cent phthalic anhydride} \end{aligned}$$

TABLE I.—SUMMARY—PHTHALIC ANHYDRIDE DETERMINATIONS.
Figures in *italic* are calculated equivalents from figures reported.

	Sample	Calculated	Laboratory I	Laboratory II	Laboratory III	Laboratory IV	Laboratory V	Laboratory VI	Minimum	Maximum
Non-Volatile Content	No. 1.....	100.0	100.0	99.1	100.0	100.0	100.0	99.5	99.1	99.5
	No. 2.....	50.0	50.3	50.2	50.15	49.8	50.2	50.3	49.8	50.3
	No. 3.....	50.0	50.22	50.3	50.90	50.0	49.7	50.5	49.7	50.9
	No. 4.....	50.0	47.19	46.5	49.76	47.5	47.1	47.4	46.5	49.76
Phthalic Anhydride Content	Kappelmeier Method—Samples									
	No. 1.....	29.73	29.62	29.90	29.80	29.5	29.68	30.8	29.5	30.8
	No. 2.....	8.65	9.08	9.50	9.23	9.1	9.16	9.62	9.08	9.62
	No. 3.....	{ 14.92 }	17.32	17.5	17.25	17.4	16.90	17.10	16.90	17.50
	No. 4.....	{ 3.15 ^a }	15.00	15.17	15.4	15.32	15.1	14.90	15.65	15.65
	Kappelmeier Method—Solid Basis									
	No. 1.....	29.73	29.62	30.2	29.80	29.5	29.68	31.1	29.5	31.1
	No. 2.....	17.30	18.05	18.90	18.36	18.3	18.14	19.1	18.05	19.10
	No. 3.....	{ 29.85 }	34.51	34.8	34.09	34.8	34.07	33.9	33.90	34.80
	No. 4.....	{ 6.30 ^a }	30.00	32.15	33.2	30.84	31.8	31.72	33.1	33.20
	Navy Method—Solid Basis									
	No. 1.....	29.73	29.76	....	27.60 30.85	27.7	29.60	31.2 36.9		
	No. 2.....	17.30	18.02	4.6 37.5	15.87 13.98	15.9	18.07	18.9 20.2		
	No. 3.....	{ 29.85 }	....	6.6	30.44	....	....	28.7		
	No. 4.....	{ 6.30 ^a }	34.13	38.8	31.69	30.8	30.90	35.3		
	No. 3.....	{ 29.85 }	....	6.6	30.44	....	....	28.7		
	No. 4.....	{ 6.30 ^a }	34.13	38.8	31.69	30.8	30.90	35.3		
	No. 3.....	{ 29.85 }	....	6.6	30.44	....	....	28.7		
	No. 4.....	{ 6.30 ^a }	34.13	38.8	31.69	30.8	30.90	35.3		
	No. 3.....	{ 29.85 }	....	6.6	30.44	....	....	28.7		
	No. 4.....	{ 6.30 ^a }	34.13	38.8	31.69	30.8	30.90	35.3		

^a Polybasic acid other than phthalic anhydride.

For distribution to the committee, samples of four different resins were made up by an operator familiar with this type of work who made a careful check on each resin of the raw material used, the yield of resin obtained, and the phthalic anhydride which was volatilized in the making of each resin. It was therefore felt that the calculated figure in each instance was very close to the actual phthalic anhydride content. These resins were as follows:

1. A linseed modified phthalic glyceride in solid form.
2. A phthalic glyceride modified with a mixture of linseed, tung oil, rosin and phenol condensate, supplied in solution form.
3. A linseed modified alkyd resin containing a substantial proportion of maleic as well as phthalic anhydride, supplied in solution form.
4. An alkyd resin modified by mixture with urea resin and supplied in solution form.

Table I shows the results obtained on these samples by the six different laboratories cooperating in this work.

In reviewing results on non-volatile content, it appears that only two laboratories ran sample No. 1, the others assumed that this would be 100 per cent solids. Samples Nos. 2 and 3 showed close checks to the calculated 50 per cent resin contents. Determinations on sample No. 4 show appreciable variation from each other and from the calculated non-volatile content. Most of the laboratories figured their phthalic anhydride determinations as percentage of the solid resin. Figures calculated from these to complete the tabulation are shown in *italics*.

In the results obtained by the Kappelmeier Method, remarkably good agreement was obtained among the different laboratories. On sample No. 1 results of five laboratories were in almost exact accordance with the calculated phthalic content and the sixth laboratory showed only minor variation. On sample No. 2 there was close agreement among the six laboratories but all ran slightly high

compared to the calculated content which is apparently due to the type of resin.

In the percentage of phthalic anhydride reported for sample No. 3 there was excellent agreement among the six laboratories. On a solid basis the minimum reported was 33.9 per cent and the maximum 34.8 per cent. This resin, however, actually contained only 29.85 per cent phthalic anhydride but it also contained 6.3 per cent of another polybasic acid. The latter would be equivalent to 5.32 per cent of its anhydride. Or on a molecular weight basis, it would be equivalent to 8.05 per cent of phthalic anhydride. It is evident that the analytical results come about midway between the actual phthalic anhydride content and the total dibasic acid calculated to equivalent phthalic anhydride.

Results on resin No. 4 are in good agreement with each other and with the calculated phthalic anhydride content of the sample. When figured to solid basis the variations in non-volatile content introduce wider variations from the calculated phthalic anhydride content.

In reviewing results by the Navy Method it can be noted that only two laboratories obtained reasonably good agreement with results obtained by the Kappelmeier Method and with the calculated actual phthalic anhydride content of the resins. One other laboratory obtained good checks between duplicate tests but not with calculated results while the other three laboratories showed wide discrepancies in their results.

In view of the results obtained by this group, it has recommended the adoption of the Kappelmeier Method, outlined above, as a tentative A.S.T.M. method for determination of phthalic anhydride in alkyd resin solutions and varnishes.²

²This method was accepted by the Society for publication as the Tentative Method of Test for Phthalic Anhydride Content of Alkyd Resin Solutions (D 563 - 40 T), 1940 Supplement, Part III, to Book of A.S.T.M. Standards.

Quantitative Spectrographic Analysis of Steels¹

By S. Vigo²

SYNOPSIS

The use of the spectrograph in routine steel analysis has definite advantages. In its application at the Watertown Arsenal to steels containing less than 1.5 per cent of the element under analysis, it saves time and material and is a reliable tool. Routine determinations of molybdenum, vanadium, chromium, manganese, silicon, copper, aluminum, and titanium with a 3-m. grating spectrograph are described. A spark discharge between rounded corners of $\frac{1}{4}$ in. square specimens of the material under test is controlled by ultraviolet irradiation of the spark gap. Analysis is based on standard steel calibration curves relating the logarithm of the alloy content to the difference in the blackenings of alloy line and comparison iron line. Mean relative errors in routine analyses of some of the elements were determined, and vary between 3.52 per cent and 8.38 per cent. Mean relative deviation in reproducibility varies between 1.70 per cent and 4.96 per cent.

CONSIDERABLE research has been carried out in recent years on the application of the spectrograph to metallurgical analysis. Despite this, chemists in the ferrous field, in general, have been slower than those in the non-ferrous fields to utilize the spectrograph for their analytical problems. Yet, this method of analysis should interest steel chemists, because the concentration of alloying elements of most steels is in the proper range, that is, below 1.5 per cent, for the most profitable use of the spectrograph as an analytical tool.

With particular reference to steel analysis, some of the advantages of spectrographic methods are: (1) all elements amenable to spectrographic treatment can usually be determined from one spectrum exposure; (2) the large number of samples of a given type of composition in the steelworks laboratory favors economical routine analysis with the spectrograph, with the actual saving of considerable man-time over wet chemical analysis; (3) although at ordinary alloy concentrations no gain in accuracy usually is expected, there is a definite, inherent superiority over routine wet analysis as the concentration becomes low; (4) laboratory overhead may be reduced by substituting photographic materials for analytical reagents; and (5) an all-inclusive record is obtained for the detection of trace metals or contaminations incidental to the production of steel.

Important advances in large-scale spectrographic installations for cast iron foundry control have been described by Vincent and Sawyer.^{3,4} Using somewhat

different methods and apparatus, the spectrographic Laboratory at the Watertown Arsenal has been making practical application of the spectrograph in routine steel analysis since 1936. An unusual feature of the Watertown equipment is the use of a concave grating for spectrum dispersion, instead of a quartz prism, as in most industrial spectrographs. It is believed that a description of the work of this laboratory should be of interest.

SCOPE

Routine determinations of molybdenum, vanadium, chromium, silicon, and manganese are made in this laboratory daily. In addition, frequent analyses are made for copper and aluminum, and occasionally for titanium. The range of compositions covered is shown in Table I.

TABLE I.—COMPOSITIONS COVERED.

	Range of Compositions, per cent	
Molybdenum.....	0.15	to 1.00
Vanadium.....	0.05	to 0.30
Chromium.....	0.003	to 1.50
Silicon.....	0.09	to 0.50
Manganese.....	0.30	to 1.25
Copper.....	0.009	to 1.50
Aluminum.....	0.005	to 1.50
Titanium.....	0.10	to 0.60

Nickel and tungsten, due to their infrequent occurrence in the alloying range where spectrographic accuracy compares favorably with that of chemical analysis (up to 1.5 per cent), are not determined spectrographically. An attempt was made to determine zirconium in steel but, because of very pronounced local segregation of that element in the test specimens, it was unsuccessful.

APPARATUS

Grating Spectrograph:

The spectrograph is a diffraction grating instrument, built by Capt. D. J. Crawford, Ordnance Dept., U. S. Army, in collaboration with G. R. Harrison of Massachusetts Institute of Technology. The grating mounting is that of Paschen. For the theory and discussion of this mounting, reference may be made to Wood⁵ and Dieke.⁶ Dispersion is obtained by a Johns Hopkins concave speculum grating of 3-m. radius of curvature, and ruled with 15,000 lines per inch over a distance of 4 in. and height of 2 in. Three orders of spectra are available. The first, with a dispersion of 5.2 Å per mm., is used for quantitative and for general qualitative analysis. The second order (2.6 Å per mm.) finds application in qualitative analysis of complex alloys. The need for the third order (1.7 Å per mm.) has not arisen.

The arrangement of the spectrographic laboratory and apparatus is shown in Fig. 1. High-tension equipment and microphotometer are located in other rooms.

The grating, slit, and camera track are firmly mounted for rigidity on five concrete blocks 33 in. high, which stand on a concrete floor 10 in. deep.

⁵ R. W. Wood, "Physical Optics," Third Edition, The Macmillan Co., p. 262 (1934).

⁶ G. H. Dieke, "Characteristics of the Eagle Mounting of the Concave Grating," *Proceedings, Sixth M.I.T. Spectroscopy Conference*, 1938, pp. 71-79 (1939).

NOTE.—DISCUSSION OF THIS PAPER IS INVITED, either for publication or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia, Pa.

¹ Presented at the Forty-third Annual Meeting, Am. Soc. Testing Mats., Atlantic City, N. J., June 24-28, 1940.

The statements and opinions are to be understood as individual expressions of the author and not those of the Ordnance Department.

² Junior Chemist, Watertown Arsenal, Watertown, Mass.

³ H. B. Vincent and R. A. Sawyer, "The Spectrograph in the Iron Foundry for Rapid and Accurate Control Analysis," *Journal of Applied Physics*, Vol. 8, No. 3, pp. 163-173 (1937).

⁴ H. B. Vincent and R. A. Sawyer, "Spectroscopic Analysis in Ford Motor Co. Foundry," *Metal Progress*, Vol. 36, No. 1, pp. 35-39 (1939).

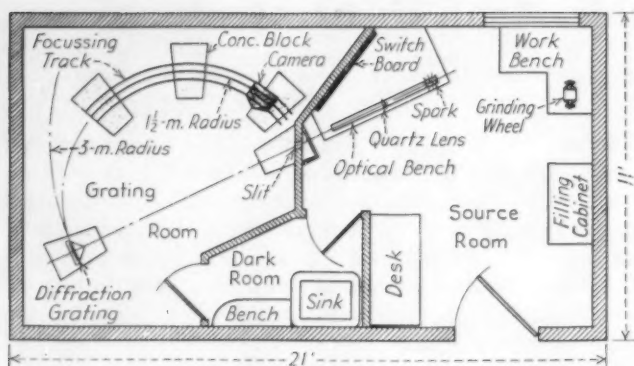


Fig. 1.—Schematic Plan of Spectrographic Laboratory.

Racking down of the photographic plate is done by means of a device, shown in Fig. 2 (a), operated by a flexible cable from the source room. Another cable, also operated from the source room, raises a partial shutter in front of the photographic plate to permit one end of the plate to continue receiving exposure while the remainder is masked off. The purpose of this arrangement, illustrated in Fig. 2 (b), is to give the silicon line-pair, Si 2881.578 Å-Fe 2941.343 Å, a longer exposure than the other test lines.

For quantitative work, the slit opening is set at 0.15 mm. to provide broad lines, which are easily microphotometered. The optical arrangement of the source, quartz lens, and slit is such that the grating is just filled with light.

Accessories:

A weakening filter, also illustrated in Fig. 2 (b), is applied at the plate to reduce the excess intensity of the line-pair used for chromium analysis. The filter, which is a Wratten⁸ No. 96 neutral tint filter, 2 by 2 in., with a nominal transmission of 75 per cent in the visible and approximately 25 per cent at Cr 3578 Å, is used for steels of higher than 0.5 per cent chromium content.

A rotating variable sector disk, placed between the lens and slit, prevents overexposure of the copper and aluminum test lines in steels containing over 0.5 per cent copper or 0.3 per cent aluminum. Such steels are given, in this manner, a weaker spectrum exposure in addition to their regular exposures.

Electrical:

Excitation of the sample is produced by a condensed spark of about 10,000 v. The primary circuit includes a choke coil for smoothing out fluctuations and a variable resistance for regulation. The transformer has a rating of 200 w. The secondary circuit includes a condenser of 0.0013-μf capacity and an inductance of 0.019 mh. Primary voltage and amperage are measured by suitable meters and usually run between 80 to 90 v. and 1.3 to 1.4 amp., respectively.

Whenever the primary characteristics exceed these values, the spark discharge is likely to be spasmodic, with intervals of perhaps several seconds between sparks. It

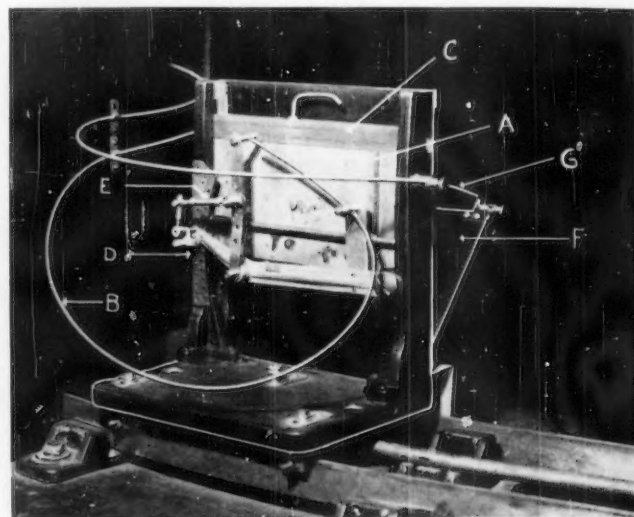
⁷ G. R. Harrison, "M.I.T. Wavelength Tables," John Wiley and Sons, New York, N. Y. (1939). (All wavelengths in this paper are taken from this source.)

⁸ Eastman Kodak Co., "Wratten Light Filters" (1936).

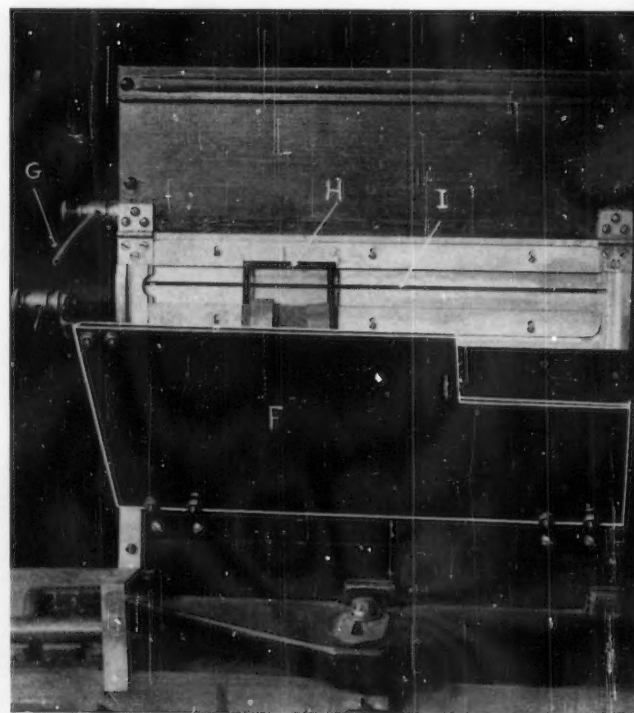
has been found that irradiating the spark gap with ultra-violet light from a mercury-vapor quartz lamp normalizes such a discharge. Since it has a slightly depressing effect on normal sparks, irradiation is applied only to the occasionally erratic discharge. The lamp is mounted about 12 in. from the spark gap and is used without filters.

Microphotometer:

A conventional nonrecording type microphotometer, constructed in the Arsenal shops, and incorporating a



(a) Rear view. A = plate holder; B = cable for racking down plate; C = weight; D = escapement; E = shock-absorbing connecting link; F = partial shutter; G = cable for partial shutter.



(b) Front view. F = partial shutter; G = cable for shutter; H = filter for chromium determination; I = camera slot.

Fig. 2.—Camera.

TABLE II.—TEST LINES USED IN ANALYSIS.

Alloy Line	Iron Line	Analysis Range, per cent	Remarks
Mo 3864.110 Å	Fe 3906.482 Å	0.15 to 1.00 Mo	Al 3092.713 Å interferes, when Al > 0.2% Cr 3093.488 Å interferes, when Cr > 3% Weakened by filter Not filtered Receives longer exposure. No interference by Cr 2881.931 Å has been observed when Cr < 1.16%
V 3093.108 Å	Fe 3091.578 Å	0.050 to 0.30 V	
Cr 3578.687 Å	Fe 3558.518 Å	0.50 to 1.50 Cr	
Cr 3578.687 Å	Fe 3594.636 Å	0.003 to 0.50 Cr	Spectrum intensity reduced 50% by means of sectored disk Spectrum intensity reduced 90% by means of sectored disk
Si 2881.578 Å	Fe 2941.343 Å	0.09 to 0.50 Si	
Mn 3474.133 Å	Fe 3468.679 Å	0.30 to 1.25 Mn	
Cu 3273.962 Å	Fe 3265.619 Å	0.009 to 0.30 Cu	Spectrum intensity reduced 50% by means of sectored disk Spectrum intensity reduced 50% by means of sectored disk
Cu 3273.962 Å	Fe 3286.755 Å	0.30 to 0.90 Cu	
Cu 3273.962 Å	Fe 3227.747 Å	0.90 to 1.50 Cu	
Al 3961.527 Å	Fe 3917.185 Å	0.005 to 0.30 Al	Spectrum intensity reduced 50% by means of sectored disk Spectrum intensity reduced 50% by means of sectored disk
Al 3961.527 Å	Fe 3906.482 Å	0.30 to 0.90 Al	
Al 3944.032 Å	Fe 3906.482 Å	0.90 to 1.50 Al	
Ti 3088.025 Å	Fe 3083.742 Å	0.10 to 0.60 Ti	

Weston photronic cell and a Leeds & Northrup type R galvanometer (period, 5.25 sec.), measures line blackenings.

SPECTRUM LINES USED FOR ANALYSIS

Because of the numerous iron lines in the steel spectrum interfering with alloy lines, relatively few of the latter are available for analysis. The requirements of adequate sensitivity to concentrational changes and of proximity of a suitable iron line for internal standard use further restrict the number of alloy lines. For such reasons, it was necessary to experiment with five different chromium lines before a satisfactory one was found. To prevent overexposure, this line, Cr 3578.687 Å, together with its internal standard iron line at 3558.518 Å, is weakened by means of the filter described above. On the other hand, Si 2881.578 Å, though well resolved, is too faint to be used for analysis under the same exposure time holding for the other elements. To obviate an additional spectrum for the determination of silicon, the partial shutter was installed, permitting exposure of the silicon line-pair to continue after the remainder of the plate has been masked off. These devices may find application, in principle at least, to other types of grating or prism spectrographs.

The spectrum region above 3500 Å has not been explored to a great extent for quantitative ferrous analysis, largely because with the quartz prism instruments generally employed, the dispersion in that region rapidly becomes too low to deal with the complex iron spectrum. The grating, however, is not subject to this limitation. Its practically uniform dispersion makes available useful test lines in other parts of the spectrum.

In Table II are listed the various line-pairs, the analysis ranges for which they are suited, and remarks concerning conditions under which they are used. The three interferences noted in this table are not of great importance, since the combinations necessary to produce them do not occur in routine analysis at the Arsenal.

STANDARDS

Spectrographic analysis at the Watertown Arsenal is based on standard steels. Some of these steels were especially cast to serve as standards, while others were adapted from steels originally designed for other purposes. In all cases, standards were carefully analyzed by wet methods. Commercial steel laboratories cooperated in check-analyzing the molybdenum and vanadium series

of standards. Those steels on which all analysts agreed were taken as standards. Since the various analysts disagreed widely on some steels, and since in practice the spectrograph ultimately would be required to comply with the Arsenal chemical determinations, it was decided that only this laboratory would check subsequent standards. Certain steel companies and the National Bureau of Standards generously supplied other accurately analyzed standard steels.

To assure homogeneity in locally manufactured standard steels, 60-lb. ingots were cast and subsequently forged in accordance with sound metallurgical practice to 2-in.



Fig. 3.—Mounting of Electrodes.

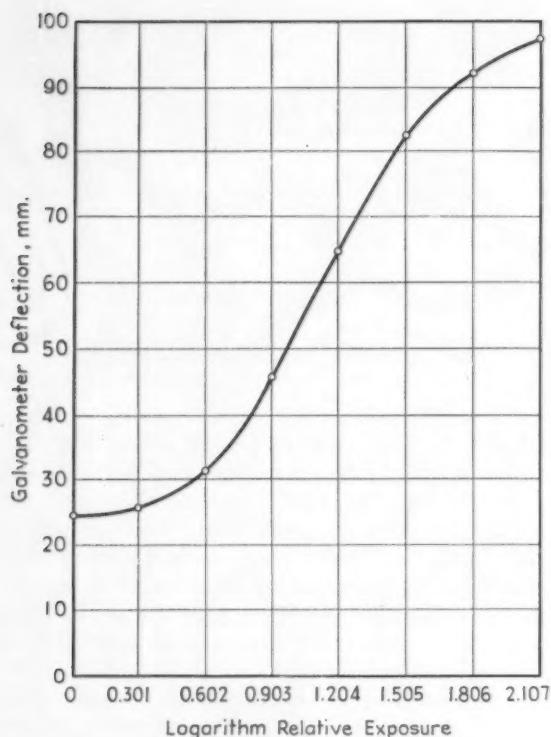


Fig. 4.—Galvanometer Deflection versus Log Relative Exposure Time.

rounds, from which the electrodes were cut and "chips" taken for check analysis. Standards prepared in this manner were repeatedly sparked, their spectra photographed, and line blackenings evaluated, as described below.

PREPARATION OF SPECIMENS FOR SPARKING

Solid mutual electrodes, each $\frac{1}{4}$ in. square and 1 to 2 in. long, are used for analysis. Accurate machining is not necessary. The three edges adjacent to a corner at each end of the bars are lightly rounded off on a grinding wheel. Electrode holders, illustrated in Fig. 3, clamp the bars in position so that the spark discharge between the prepared corners is vertical. This method of grinding and mounting the specimens produces a compact bundle of sparks, the image of which is similar in compactness to that of an arc discharge.

A test cup poured with each heat of steel in the foundry furnishes specimens for the spectrograph as well as material for chemical analysis. The usual procedure is to send the cups in groups of five to ten to the test specimen shop, where the $\frac{1}{4}$ -in. bars are quickly cut out by means of abrasive wheels. Experiments to eliminate this step by casting the bars directly are in progress.

PROCEDURE AND PHOTOMETRY

The bars are given a preliminary sparking of about 20 sec., during half of which time the primary current is increased to 3 amp. to hasten the burning-off process. Exposure time is 25 sec. plus an additional 25 sec. for the silicon line-pair. The spark gap, which is 5 mm. long, is irradiated with the mercury-vapor lamp if the voltage and amperage rise above 90 v. and 1.4 amp., respectively.

Both ends of the bars are sparked to give duplicate exposures, although ordinarily only one spectrum is

microphotometered; the other is there for checking in the event of noncompliance with the chemical specification. The spectra of ten to twelve steels in duplicate are photographed on one plate.

Eastman "40" plates, 4 by 10 in., are used, and developed in Eastman D-61a developer 7 min. at 65 F. Experiments are being conducted to reduce the 45 min. now required for complete processing of the plate.

In the operation of the microphotometer, total galvanometer deflection is standardized at 100 mm.; the setting on the galvanometer scale for dark photocell condition is 100 mm. and for unimpeded illumination of the cell is 0 mm. Readings are made to the nearest $\frac{1}{4}$ mm. Line blackenings (galvanometer deflections) are used without converting to densities or intensities and without subtracting adjacent background blackenings. Over a certain range of blackening, proportionality exists between blackening and log exposure. As seen from Fig. 4, which is a plot of galvanometer deflections against a series of exposures of the Eastman "40" plate to a source of continuous ultraviolet light comprising 3400 Å to 3800 Å, the blackening versus log exposure-time relation is linear between values of approximately 40 mm. and 80 mm. The limits of linearity, which vary slightly with the batch of plates, are easily determined by impressing a small, stepped wedge directly on the plate without the intervention of the spectrograph. This is done by means of a logarithmically sectored disk and an auxiliary, Uviol-filtered incandescent lamp, both located in the grating room. The wedge is

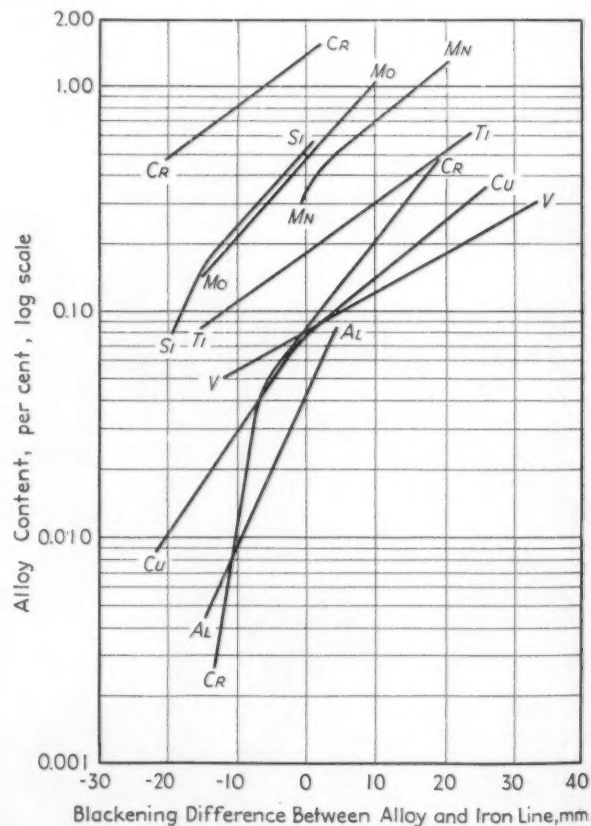


Fig. 5.—Log Alloy Content Plotted Against Difference in Blackenings of Alloy and Iron Line.

(Note—To avoid confusion, Al and Mn curves have been moved 5 mm. to the right.)

not employed for plate calibration, but for a rough check on the linearity limits of blackening, thereby making certain that all test lines are properly exposed.

Alloy content calibration curves of the standard steels are prepared by plotting the logarithm of the alloy content against the difference in blackenings (in millimeters) of alloy and internal standard lines. Figure 5 shows curves for the determination of molybdenum, vanadium, chromium (two ranges), manganese, silicon, copper, aluminum, and titanium. It will be seen that over a substantial portion of the working range, the plot of blackening difference *versus* log alloy content is linear. The standard steels are checked frequently for constancy of calibration. The curves of most of the elements require merely occasional adjustment, while the silicon curve may require a slight adjustment for each box of plates.

The blackening differences encountered in most routine determinations lie between 0 mm. and ± 10 mm.; silicon differences, however, may fall below -10 mm. Near-equality of alloy and internal standard lines, by reducing the influence of variation of the plate contrast, diminishes the need for calibrating each plate and adjusting for contrast variation. This need is further diminished by standardization of development procedure and by frequent checking of the standards, especially of those for silicon.

In routine analysis, percentage values are obtained by applying the blackening differences of the specimens under analysis to the working curves or, more conveniently, to tables prepared from the curves. No computations of

ratios, conversions to densities or intensities nor plotting of plate calibration curves are performed.

TIME REQUIRED FOR ANALYSIS

The total elapsed time required for one operator to grind ten pairs of bars, make duplicate spectrum exposures, process the plate, evaluate blackenings (one spectrum of each steel) and read off the results for molybdenum, chromium, vanadium, silicon, and manganese is about 5 hr. This compares with about 12 hr. required to do the same analyses by wet chemical methods. Two operators, one at the spectrograph and the other at the microphotometer, could easily handle about 50 samples in an 8-hr. day. Once standard procedures are established, nonprofessional laboratory assistants are capable of assuming the spectrographic work.

ACCURACY

The accuracy of the spectrographic analysis of steels was checked by running a large number of parallel spectrographic and chemical determinations. Correctness of chemical analyses, of course, was assumed, although in a few, isolated instances this was open to question. The number of parallel runs ranged between 40 for molybdenum and 322 for manganese. The molybdenum series, made in the early days of spectrographic analysis at the Arsenal, showed a satisfactory mean error of 5.20 per cent, based on the chemical values. Since then, the practice of molybdenum determination has been considerably improved, largely by the use of a better iron line for comparison. It is believed that the accuracy of present molybdenum practice is more nearly like that of chromium and manganese, for which the mean relative errors were 3.52 per cent and 3.57 per cent, respectively. Although, by comparison, the mean silicon error of 8.38 per cent may seem high, the average absolute deviation from the parallel chemical figures was only 0.015 per cent,

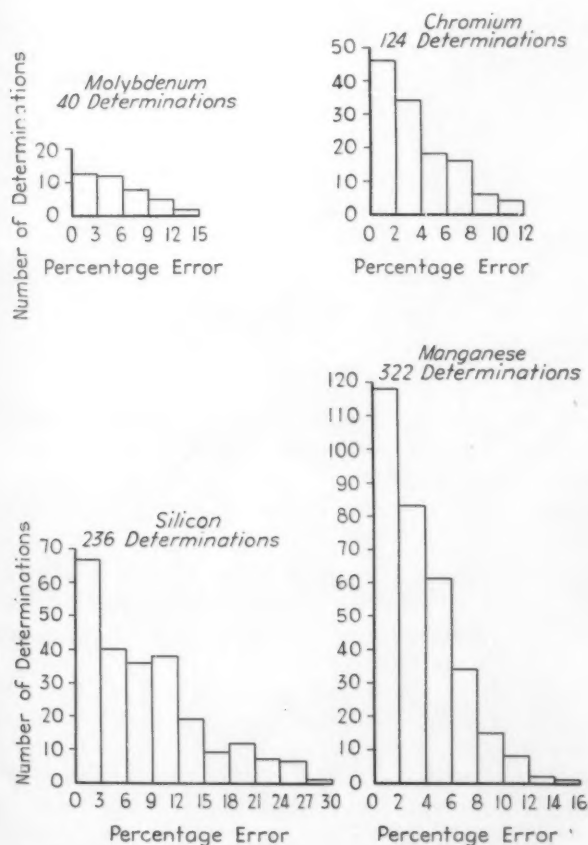


Fig. 6.—Data on Accuracy. Distribution of Deviations in Molybdenum, Chromium, Silicon, and Manganese Spectrographic Determinations Relative to Chemical Determinations.

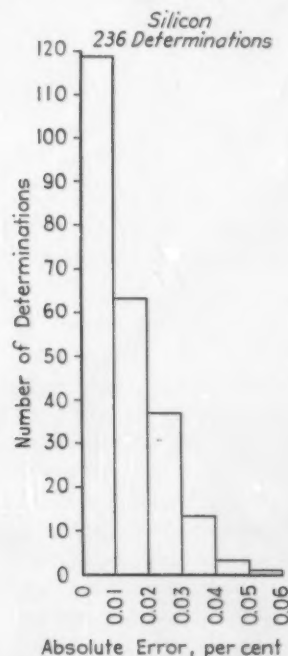


Fig. 7.—Distribution of Absolute Deviations of Spectrographic from Chemical Determinations of Silicon in the Range of 0.12 to 0.30 per cent Silicon.

TABLE III.—REPEAT DETERMINATIONS.

Element	Plate	Analysis, per cent						
		Steel No. 3046	Steel No. 3047	Steel No. 3091	Steel No. 3092	Steel No. 3093	Steel No. 3094	Steel No. 3095
Molybdenum	No. 1393	0.53	0.53	0.50	0.49	0.51	0.49	0.50
	No. 1400	0.52	0.53	0.50	0.49	0.48	0.52	0.49
	No. 1413	0.53	0.52	0.49	0.51	0.49	0.51	0.49
	No. 1424	0.52	0.52	0.51	0.50	0.53	0.51	0.47
	No. 1437	0.52	0.52	0.50	0.51	0.49	0.51	0.455
Mean		0.524	0.524	0.500	0.500	0.500	0.508	0.481
Chromium	No. 1393	0.835	0.945	0.86	0.85	0.82	0.945	0.975
	No. 1400	0.795	0.93	0.90	0.875	0.85	0.93	0.975
	No. 1413	0.885	0.96	0.945	0.82	0.945	1.005	0.96
	No. 1424	0.82	0.945	0.795	0.82	0.85	0.975	0.995
	No. 1437	0.81	0.915	0.915	0.85	0.82	0.975	0.93
Mean		0.829	0.939	0.883	0.843	0.857	0.966	0.967
Vanadium	No. 1393	0.063	0.089	0.079	0.078	0.087	0.097	0.089
	No. 1400	0.058	0.082	0.075	0.069	0.070	0.087	0.082
	No. 1413	0.070	0.087	0.075	0.070	0.078	0.087	0.093
	No. 1424	0.065	0.089	0.076	0.075	0.079	0.093	0.086
	No. 1437	0.068	0.091	0.089	0.079	0.082	0.104	0.097
Mean		0.065	0.088	0.079	0.074	0.079	0.094	0.089

or $1\frac{1}{2}$ "points." This deviation is not considerable for steels containing, on the average, approximately 0.20 per cent silicon. There was ground for belief that some of the larger discrepancies were caused by accidental inclusion of particles of slag in the sample for chemical analysis.

The distribution of relative errors, as well as the mean error, is of interest and is given in Fig. 6. Also, the distribution of absolute errors in the silicon determination is shown in Fig. 7, from which it is evident that the most frequent deviation was that of 0 to 0.01 per cent.

REPRODUCIBILITY

Data on reproducibility were obtained from a group of seven steels analyzed five times for molybdenum, chromium, and vanadium on five different plates. Each determination consisted of a single spectrum exposure. The analytical results are given in Table III. The average relative deviation based on the mean analysis of each steel is 1.70 per cent for molybdenum, 2.84 per cent for chromium, and 4.96 per cent for vanadium. From a practical point of view, this is equivalent to less than one "point" deviation for molybdenum, about $2\frac{1}{2}$ "points" for chromium, and less than $\frac{1}{2}$ "point" for vanadium. Distribution of the 105 relative deviation values is shown in Fig. 8.

Acknowledgment:

Grateful acknowledgment is made to the Bethlehem Steel Co., Climax Molybdenum Co., Crucible Steel Co., National Bureau of Standards, Union Carbide and Carbon

Research Laboratories, and Vanadium Corporation of America for check analyzing or supplying standard steels. Appreciation is extended to Col. G. F. Jenks and to Capt. D. J. Crawford, Jr., Ordnance Dept., U. S. Army, both formerly stationed at the Watertown Arsenal, for inspiration and encouragement. The assistance of the Watertown Arsenal Laboratory Staff is acknowledged; in particular, of A. Sloan, for cooperation in chemically checking spectrographic analyses; of J. Sterner, for valuable counsel and important preliminary work in this study; and of H. L. Phillips, for design and construction of the remote control plate-racking device.

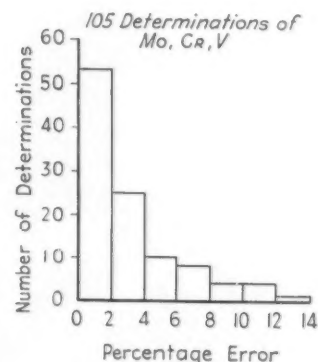


Fig. 8.—Reproducibility Data. Distribution of Relative Deviations in Repeat Analyses.

DISCUSSION

MR. H. W. DIETERT.¹—I should like to ask why Mr. Vigo used the color filter in place of a glass plate 0.001 or 0.002 in. in thickness. We use a glass plate polished and ground for the silicon line with good success.

I should also like to ask whether Mr. Vigo makes three wet analyses and takes the average, or whether he makes just one wet analysis and calls that correct. We find that considerable care must be exercised to obtain an analysis that may be used for calibration purposes.

MR. S. VIGO.²—The neutral tint filter which we use at 3578 Å has exactly the right transmission value for the

purpose required. Being only moderately stable, the filter is replaced every five or six months. I do not think a 0.002-in. glass plate would serve the purpose, since it would not be sufficiently opaque at 3578 Å.

In answer to the second question, at least three wet analyses by three different analysts were averaged in the standardization of the standard steels. For determining the accuracy of the routine spectrographic analyses, they were compared with run of the mill wet analyses.

MR. DIETERT.—May I add that we place the glass filter over the silicon line to subdue the silicon line. We find it is too dense for gray iron when sufficient exposure is used to enhance spectral lines of minor elements.

¹ President, Harry W. Dietert Co., Detroit, Mich.

² Junior Chemist, Watertown Arsenal, Watertown, Mass.

The Determination of the Thermo-Viscosity of Light Distillates

A.S.T.M. Tentative Method of Test for Kinematic Viscosity (D 445 - 39 T)¹

By Lyman R. Brown²

FOR MANY years, the Saybolt thermo-viscosimeter^{3,4} has been used in the petroleum industry for estimating the viscosity of very light distillates, such as gasoline and kerosine. This instrument consists of a capillary of specified dimensions into which the product, whose viscosity is to be determined, flows under a specified hydrostatic head. The time required for the liquid to rise from the bottom of the capillary to a mark higher up on the same is recorded. The results are expressed as the time in seconds multiplied by ten and corrected to 60 F. (15.6 C.) by a series of tables. This instrument has not been standardized by the Society because it is not as accurate as the kinematic equipment.⁵ The viscosity of kerosine is of some interest in connection with the rate of flow through a wick and the viscosity of gasoline has some effect on carburetion.⁶

TABLE I.—THERMO-VISCOSITY.

	Centistokes at 100 F. (37.8 C.)	Calculated from Formula	Actual Run	Aniline Cloud Point, deg. Fahr.	Type of Distillate
A.....	0.641	129	133	Below 0	Xylol
B.....	0.876	190	192	...	Naphtha
C.....	0.990	220	225	...	Naphtha
D.....	1.31	304	300	136 F.	Insecticide base
E.....	1.37	320	315	...	Blend
F.....	1.40	328	330	...	Turpentine
G.....	1.46	343	340	...	Blend
H.....	1.48	349	350	...	
I.....	1.50	354	355	147	
J.....	1.52	359	355	148	
K.....	1.57	372	375	159	
L.....	1.59	377	375	...	
M.....	1.60	380	380	...	
N.....	1.61	382	380	...	Kerosine
O.....	1.62	385	385	...	
P.....	1.63	388	385	...	
Q.....	1.64	390	390	...	
R.....	1.64	390	390	...	
S.....	1.67	399	400	126	
T.....	1.72	415	410	...	
U.....	1.76	422	420	...	
V.....	1.84	443	440	...	
W.....	2.01	478	485	131	Blend
X.....	2.13	519	515	...	
Y.....	2.16	526	530	...	
Z.....	2.43	598	615	...	

With a view to utilizing the kinematic viscosimeter, which has been standardized by the Society, work was undertaken to determine the possibility of establishing a correlation between kinematic viscosity in centistokes (A.S.T.M. Method D 445 - 39 T)¹ at 100 F. (37.8 C.) and Saybolt thermo-viscosity³ at 60 F. (15.6 C.). The results shown in Table I indicate that oils up to 550 thermo-viscosity show a definite correlation that is not influenced by the crude source or degree of refinement. This points

NOTE.—DISCUSSION OF THIS PAPER IS INVITED, either for publication or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia, Pa.

¹ 1939 Book of A.S.T.M. Standards, Part III, p. 647 (1939).

² General Laboratories, Socony-Vacuum Oil Co., Inc., New York, N. Y.

³ David T. Day, "Handbook of the Petroleum Industry," Vol. 1, pp. 648-654 (1922).

⁴ A. R. Fortsch and R. E. Wilson, *Industrial and Engineering Chemistry*, Vol. 17, p. 291 (1925).

⁵ "Significance of Tests of Petroleum Products," p. 46, published by Am. Soc. Testing Mats. (1937).

⁶ *Ibid.*, p. 47.

the way to the elimination of one more empirical viscosimeter.

The curve in Fig. 1 may be extended to at least as low as 0.64 centistoke and still show correlation with the Saybolt thermo-viscosity at 60 F. Beyond 550 thermo-viscosity the crude oil source and viscosity index have an influence so that it is not feasible at the higher viscosities to correlate determinations run in one apparatus at 60 F. and in another apparatus at 100 F. The fact that materials such as xylol and turpentine show the same correlation indicates that the temperature-viscosity change of these fluids is not sufficiently different from that of petroleum distillates between 60 F. and 100 F. to throw them off the curve in Fig. 1.

The thermo-viscosity may be somewhat more closely derived from the following equation than by using the graph:

Thermo-viscosity at 60 F. =

$$262 (\text{centistokes at } 100 \text{ F.}) - 39$$

and conversely

$$\text{Centistokes} = 0.00382 (\text{thermo-viscosity}) + 0.15$$

It was to be expected that the reproducibility among various laboratories would be better for kinematic determinations than for thermo-viscosity determinations. A survey was undertaken and it will be noted from Table II that thermo-viscosities were even more at variance than was expected. With nine laboratories cooperating by running three oils of 340, 315, and 385 thermo-viscosity, the average variation in thermo-viscosity calculated from centistokes was 0.34 per cent. This figure is high for kinematic determinations of lubricating oils but chances of error are greater in the series 50 tubes which should be used for kerosine or naphtha determinations. Determinations made in the series 100 tubes are subject to kinetic energy corrections because of the low efflux times.

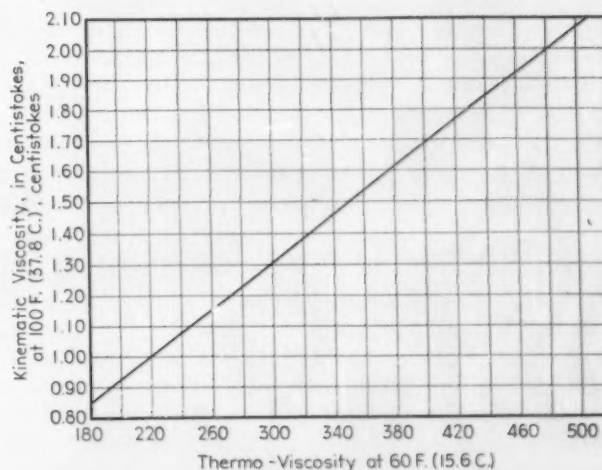


Fig. 1.

TABLE II.

Laboratory	Oil A			Oil B			Oil C		
	Centistokes at 100 F. (37.8 C.)	Calculated Thermo-Viscosity	Actual Thermo-Viscosity Run	Centistokes at 100 F. (37.8 C.)	Calculated Thermo-Viscosity	Actual Thermo-Viscosity Run	Centistokes at 100 F. (37.8 C.)	Calculated Thermo-Viscosity	Actual Thermo-Viscosity Run
1.....	1.459	343	340	1.366	319	315	1.627	387	385
2.....	1.462	344	340	1.369	319	320	1.629	388	385
3.....	1.457	342	320	1.363	318	300	1.633	389	365
4.....	1.45	341	335	1.38	322	330	1.63	388	375
5.....	1.465	345	325	1.368	319	300	1.632	388	370
6.....	1.458	343	...	1.364	318	...	1.627	387	...
7.....	1.453	341	335	1.378	322	315	1.642	391	380
8.....	1.462	344	325	1.358	316	300	1.629	388	375
9.....	1.466	345	...	1.374	321	...	1.633	389	...

The percentage variation from a standard figure of the thermo-viscosities was 2.0 per cent. This variation was determined by calculating the deviation from a figure obtained in a carefully standardized tube using a standard reference oil. The divergence of results obtained precluded the use of an average figure. In general, the results were on the low side, only two determinations being high.

It is suggested that laboratories adopting this procedure

express their results in both centistokes at 100 F. and thermo-viscosity equivalents at 60 F. with a view to accustoming the industry to think of kerosines in terms of centistokes. The greater accuracy and reproducibility of kinematic viscosities by A.S.T.M. Method D 445-39 T is a distinct advantage. Another advantage is the smaller amount of sample required (10 ml.) as compared with 250 to 300 ml. required for the Saybolt Thermo Method.

Engineering Interests of the Americas

"ECONOMIC AND ENGINEERING Interests of the Americas" will be the major theme of the annual meeting of Section M (Engineering) of the American Association for the Advancement of Science to be held at the Engineers Club of Philadelphia, Tuesday, December 31, 1940. The program comprises morning and afternoon sessions and a luncheon meeting.

At the morning session beginning at 10:00 a.m., Dr. Jerome C. Hunsaker, Massachusetts Institute of Technology, Retiring Vice-President, will address the section on "Aviation Progress." Cloyd Heck Marvin, President, The George Washington University, will discuss "Educational Relationships Between the Americas" and Raymond C. Clapper, well-known news commentator, will discuss "The Press and Inter-American Relations."

The luncheon speakers are William Culbertson, former Ambassador to Chile, and Dr. Carlos Davila, former Chilean president. This event will be combined with the regular Tuesday luncheon of the Engineers Club.

At the afternoon session beginning at 2:30 o'clock Fred Lavis, Consulting Engineer, will discuss "Engineering Developments in South America," C. L. Warwick, Secretary-Treasurer, A.S.T.M., will discuss "Inter-American Relations in the Field of Engineering Materials," and P. G. Agnew, Secretary, American Standards Assn., will cover "Exchange of Standards."

An invitation is extended to members of A.S.T.M. to attend these sessions and the luncheon.

National Chemical Exposition

THE CHICAGO SECTION of the American Chemical Society will hold its first National Chemical Exposition from December 11 through December 15, 1940, in Chicago. Dedicated to the service of chemists and chemical industry, the theme of the Exposition will be *ideas*. In the Stevens Hotel, exhibitors will show how their chemicals and apparatus can be put to new and greater usefulness and in the hall of educational exhibits,

research foundations, universities and colleges will tell the story of how not-for-profit research is helping the United States to maintain its world leadership in technology.

A series of symposia will be held on "New Developments in Chemistry and Chemical Engineering." Ten papers will be presented, each by an authority in his field. Also, at scheduled intervals during the Exposition, a carefully selected group of industrial motion pictures will show new products and new processes in chemical industry. The exposition is open without admission charge to all who are technically interested.

Publications Cover Electrical Insulation, Steel Piping, Soil Cement Mixtures, and Electrodeposits

SINCE THE APPEARANCE of the October BULLETIN in which there were announced several special technical publications, a number of other books have come off press including the compilation of A.S.T.M. Standards on Electrical Insulating Materials, A.S.T.M. Specifications for Pipe and Piping Materials for High-Temperature and High-Pressure Services, and reprints of the Report of Committee A-5 on Corrosion of Iron and Steel giving considerable data on results of inspection of the numerous research projects under way.

The compilation on electrical insulating materials sponsored by Committee D-9 is issued annually and provides in compact form all of the A.S.T.M. tests, specifications, and definitions pertaining to these materials. This book is of convenience to producers of the materials covered and to consumers alike. Copies can be procured at \$2 each; members' price, \$1.50.

The compilation of piping standards represents some 22 of the 38 A.S.T.M. specifications pertaining to these materials, this particular book covering those for use at high-temperature or high-pressure service, or both. While the compilation was developed originally at the suggestion of the Prime Movers Committee of the Edison Electric Institute, its use is much more widespread than in

this particular field. The latest compilation includes the new specifications for welding fittings, and also the classification of austenite grain size in steels, with the two insert grain size charts. Copies to members are \$1, and to nonmembers, \$1.25.

Two other groups of standards have been issued in pamphlet form for the convenience of those interested, the first covering a grouping of methods of test for soil-cement mixtures comprising three methods, as follows: Test for Moisture-Density Relations of Soil-Cement Mix-

tures (D 558 - 40 T), Wetting-and-Drying Test of Compacted Soil-Cement Mixtures (D 559 - 40 T), and Freezing-and-Thawing Test of Compacted Soil-Cement Mixtures (D 560 - 40 T). Also published in one pamphlet are the three specifications for electrodeposited coatings of zinc, cadmium, nickel, and chromium on steel (A 164 - 40 T, A 165 - 40 T, A 166 - 40 T) and the methods of test for local thickness of electrodeposited coatings on steel (A 219 - 40 T). These two pamphlets can be obtained at 25 cents each, or at reduced prices on orders in quantity.

Proposed Reference Standards of Rusting of Painted Iron or Steel Surfaces

A NUMBER OF SUBCOMMITTEES of Committee D-1 on Paint, Varnish, Lacquer, and Related Products were confronted with the problem of accurately evaluating the degree of rusting exhibited by exposure panels. The preparation of reference standards of rusting in the form of colored photographs was, therefore, assigned as a portion of the work of Subcommittee VII on Accelerated Tests for Protective Coatings. In the meantime and pending the preparation of A.S.T.M. reference standards of rusting the various subcommittees of D-1 have been using the Swedish rusting standards. Consequently, a definite relationship exists between the Swedish rusting standards and these proposed reference standards.

It became at once evident that reference standards were necessary for two types of rusting failure. The first type would be used in the evaluation of subsurface rusting (blisters) which has progressed to some degree under the paint film with or without the presence of visible rust spots. The second type is not of the subsurface type and is visible as such.

The preparation of reference standards of rusting through the use of colored photographs involved the selection of rusty surfaces which photographically would represent their true condition.

In order to do this two precautions were necessary—the first was the selection of the proper color of paint which would contrast sufficiently with the color of rust so that photographically it would avoid any error in interpretation. The second was to choose a surface which would not exhibit rust staining; otherwise rust staining might be confused with the presence of actual rust on the photograph.

Accordingly, a number of rusted surfaces were chosen and photographed. From these the proposed reference standards have been selected.

These problems involved in the preparation of reference standards of rusting were presented through the aid of colored projections to Committee D-1 in Atlantic City last June, together with proposals of specific tentative standards. It was then decided by Committee D-1 that black and white photographic representations of these proposed standards be published in the A.S.T.M. BULLETIN so that all members of the Society and, particularly, the members of Committee D-1, be familiar with this proposal, and thus be in a position to approve or disapprove this as a tentative A.S.T.M. standard. This proposed tentative reference standard is as follows:

PROPOSED TENTATIVE REFERENCE STANDARDS OF RUSTING OF PAINTED IRON OR STEEL SURFACES

Scope

1. These proposed reference standards are representative of degrees of rusting of painted iron or steel surfaces for comparative purposes and are not intended to have a direct relationship to a decision regarding repainting requirements.

Types

2. Two types of rusting, as shown in Fig. 1, are represented:

Type 1.—Rusting, not accompanied by blistering and visible as such.

Type 2.—Rusting accompanied by blistering and which is not initially evident by visible rust.

Use of Reference Standards

3. The use of these proposed reference standards requires the following precautions:

(1) Some finishes are stained by rust. This staining must not be confused with the actual rusting involved.

(2) Accumulated dirt or other material may make accurate determination of the degree of rusting difficult.

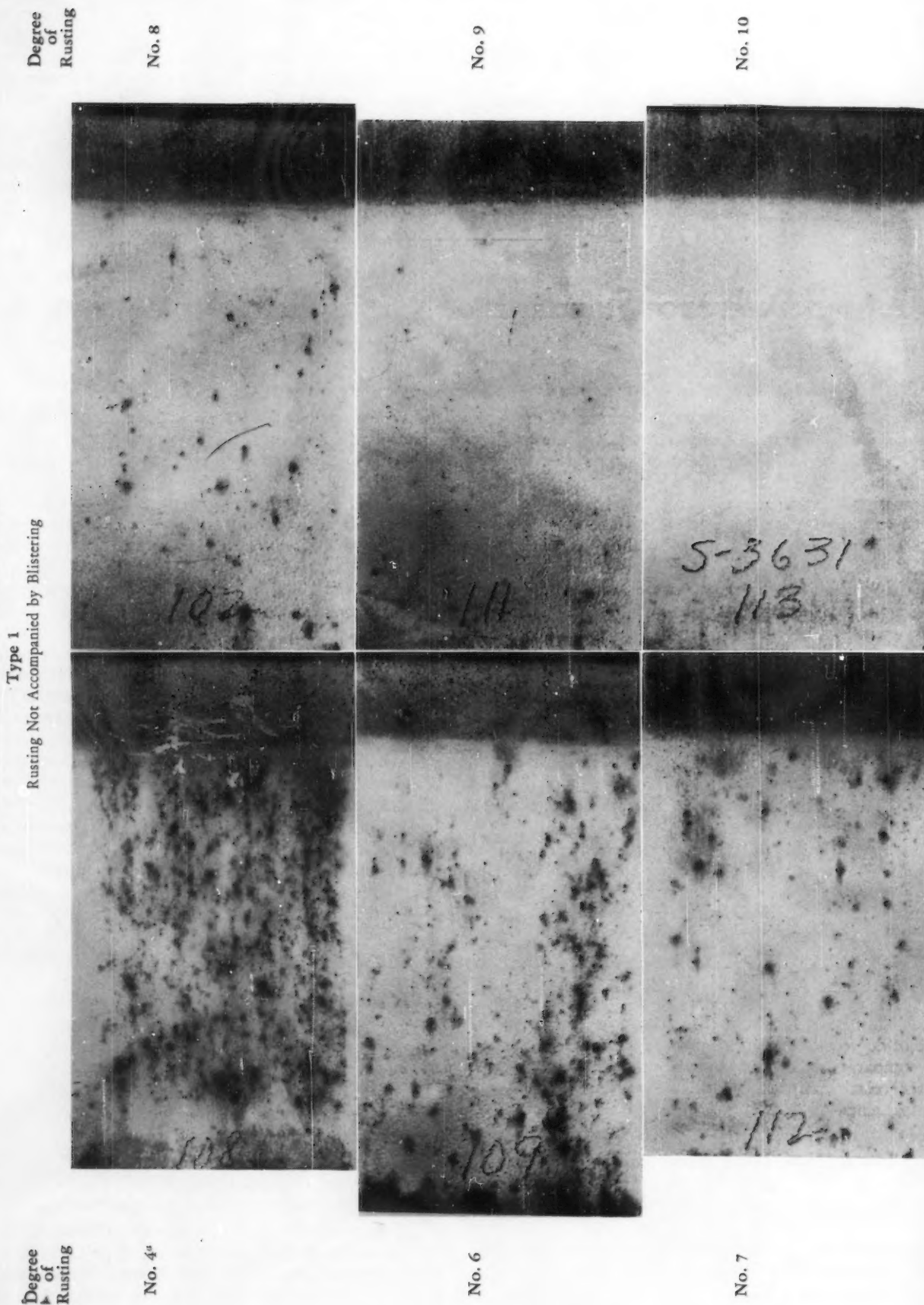
(3) Certain types of deposited dirt that contain iron or iron compounds may cause surface discoloration that should not be mistaken for corrosion.

(4) It must be realized that failure may vary over a given area and discretion must therefore be used in applying these proposed reference standards.

(5) In evaluating surfaces, consideration shall be given to the color of the finish coating, since failures will be more apparent on a finish that shows color contrast with rust, such as used in these proposed reference standards, than on a similar color, such as an iron oxide finish.

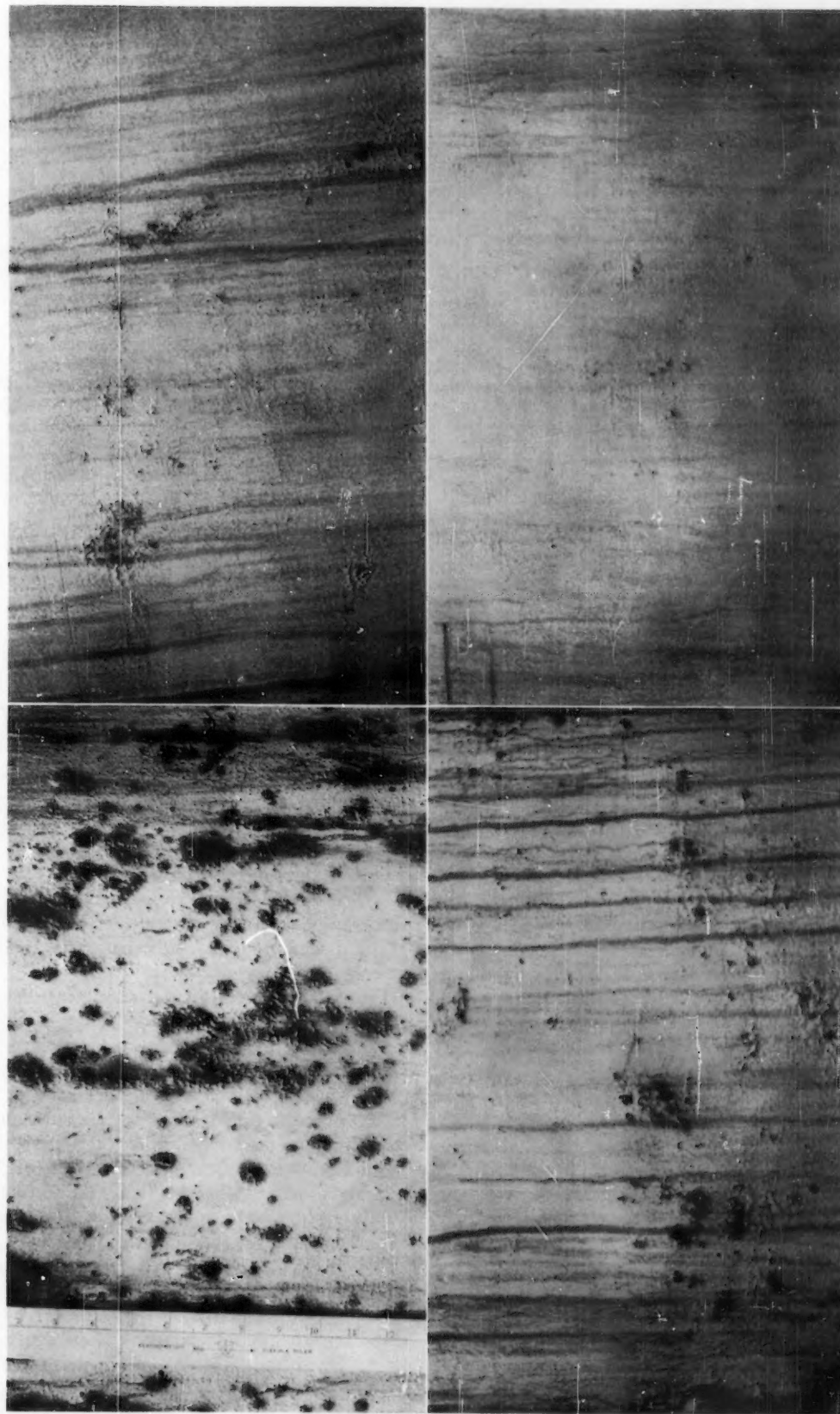
(See Following Pages)

Fig. 1.—Photographs Showing Proposed Tentative Reference Standards of Rusting of Painted Iron or Steel Surfaces.



Type 2
Rusting Accompanied by Blistering

Degree
of
Rusting



Degree
of
Rusting

No. 4^a

No. 6

No. 7

No. 8

^a Selections were made to agree within practical limits with the degree of rusting indicated for the corresponding reference standard numbers in the Swedish Rusting Standards. The subcommittee suggests that degrees below No. 4 are of no practical importance.

1940 Supplement to Book of Standards Distributed Early in December; Index to Standards Very Significant This Year

PRINTING WORK ON the 1940 Supplements to the Book of A.S.T.M. Standards was completed several days ago and as soon as binding is completed, the books will be ready for distribution. The Supplements are being furnished to the members according to the Parts of the Book of Standards they receive, instructions having previously been given by each member concerning this matter. The Supplements are in three separate volumes applying respectively to Part I, Metals; Part II, Nonmetallic Materials—Constructional; and Part III, Nonmetallic Materials—General.

INDEX TO STANDARDS

The Supplements are designed so that users can refer readily to any particular standard or tentative standard they wish to find, but instead of incorporating a detailed subject index, the Society this year is publishing its INDEX to A.S.T.M. STANDARDS simultaneously with the Supplements and each member and all others who receive the Supplements will also get a copy of the INDEX in a separate mailing. Members should note that the INDEX, now almost an indispensable part of the Book of Standards, provides up-to-date references to the Parts of the Book of Standards or Supplements where each of the 952 specifications and tests appears in its latest form.

The INDEX gives titles and serial designations of the standards under appropriate subject headings and there is also published as a separate feature a complete list of all A.S.T.M. serial designations in numeric order with the page references to publications where they appear. This INDEX should be used more and more widely by the members and those who are concerned with A.S.T.M. specifications and tests since it is designed to facilitate reference to the standards. Extra copies of the INDEX are furnished members without charge and a number of organizations get copies for their staff.

The publication also includes information about the Society, gives brief descriptions of the various publications, and has a membership application blank included.

Viscosity Index and Conversion Tables Available

AS ANNOUNCED IN the current booklet listing A.S.T.M. publications, there are being issued two new pamphlets in the petroleum field—one providing viscosity index tables, the second giving viscosity conversion tables. The index tables (36 pages) provide convenient means of obtaining this number (an empirical number indicating the effect of change of temperature and viscosity of an oil). A low viscosity index signifies relatively large change of viscosity with temperature. The values of viscosity index given are calculated according to the A.S.T.M. Method of Calculating Viscosity Index (D 567 - 40 T) and the tables are in a sense supplementary thereto and show the Saybolt Universal viscosity in seconds at 100 F. corresponding to single even units of V. I. for each whole second

Saybolt Universal viscosity at 210 F. from 40 to 161 sec.

The conversion tables (16 pages) afford a quick method of conversion from kinematic to Saybolt Universal viscosity. The tables range from 2.00 to 330.0 centistokes (32.60 to 1524.6 Saybolt seconds at 100 F.) by increments of 0.01, 0.02, 0.10, and 0.20, depending on the range. Saybolt equivalents at 210 F. are given for a centistoke range of 2.00 to 75.0. The conversion tables are based on and amplify the A.S.T.M. Standard Method for Conversion of Kinematic Viscosity to Saybolt Universal Viscosity (D 446 - 39).

Copies of these two booklets, 6 by 9 in., extra heavy paper cover, with special durable paper stock for the tables, can be obtained at the following prices:

Index Tables	Conversion Tables
1 to 9 copies, 50 cents each	1 to 9 copies, 25 cents each
10 to 24 copies, 40 cents each	10 to 24 copies, 20 cents each
25 to 99 copies, 35 cents each	25 to 99 copies, 17½ cents each
100 and over, 30 cents each	100 and over, 15 cents each

Forty-fourth Annual Meeting in Chicago

A NUMBER OF TECHNICAL features are being carefully studied for development and presentation at the Forty-fourth Annual Meeting of the Society which is to be held at the Palmer House in Chicago during the week of June 23 to 27, inclusive, 1941.

As announced in this BULLETIN, Committee E-6 on Papers and Publications has extended its usual call for papers for presentation at the meeting. From the large number of offers which it is expected will be received, a selection will be made for inclusion in the program.

Certain groups of technical papers, either in the form of symposia or round-table discussions, will be featured. Continuation of the series of symposia on the significance of properties of metals is planned, the session this year featuring hardness and hardness testing. There are three papers in prospect from outstanding authorities in the field, one reviewing the present types of tests, another dealing with fields of applications and results, and a third discussing and evaluating the significance of the test.

Other sessions will cover classification of soils, testing of water by electrical conductivity methods and conditioning, the latter probably taking the form of a round table.

Two other features which have been growing in popularity and interest will take place during the meeting: namely, the Sixth Exhibit of Testing Apparatus and Related Equipment, these exhibits being held in the odd-numbered years, and the Fourth Photographic Exhibit. Leading firms in the apparatus and laboratory supply fields will be invited to participate in the instruments exhibit and it is expected there will be a number of research and technical displays in addition.

An invitation blank will be sent early in 1941 to each member and committee member in the Society inviting them to submit prints in the photographic exhibit. Meanwhile members who are interested may wish to earmark prints for this. It is probable that the general theme of the exhibit will be some phase of engineering materials testing or research, with emphasis on some particular angle.

The Influence of Variations in Wood Grain Angle upon the Accelerated Weathering Testing of Exterior House Paints¹

By W. W. Kittelberger²

FOR A NUMBER OF years this laboratory has been using red cedar panels meeting the A.S.T.M. Standard Specifications for Wood to Be Used as Panels in Weather Tests of Paints and Varnishes (D 358 - 38)³ in the testing of exterior house paints. Some years ago several observations were made which threw considerable doubt upon the adequacy of the limits fixed by these specifications and indicated strongly that variations permissible under these specifications exerted an appreciable influence upon the test results, particularly for paints of similar durability characteristics. In an effort to determine the effect of these variables more accurately and, if possible, isolate them, a series of experiments was conducted, the results of which may be of general interest, especially since they enabled us to improve the reliability of our accelerated weathering tests to a considerable degree.

Six sets of ten panels each were finished with three coats of six different paints. One week after application of the last paint coat, the panels were placed under exposure in our accelerated weathering unit. Because of the limited capacity of this unit, the panels were exposed in two groups of 30 panels each. In each set, the panels were numbered in such a manner that the operator who actually graded the films was not aware of the identity of the paint involved.

While under exposure, the panels were examined every two weeks for such film integrity failures as checking, cracking, and scaling and were graded for degree of failure on the basis of the following arbitrary numerical system which has been in successful use in our laboratory for a number of years:

- 0 = No failure
- 5 = Slight failure
- 10 = Moderate failure
- 15 = Bad failure
- 20 = Very bad failure

A single numerical value which would be representative of both the rate and degree of integrity failure, and at the same time would make allowance for differences in the seriousness of the various types of failure, was obtained by adding together (1) the sum of the biweekly checking gradings, (2) twice the sum of the biweekly cracking gradings, and (3) three times the sum of the biweekly scaling gradings. It is, of course, realized that this sys-

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¹ Presented before Subcommittee VII on Accelerated Tests for Protective Coatings of the Society's Committee D-1 on Paint, Varnish, Lacquer, and Related Products at their meeting held on June 27, 1940, at Atlantic City, N. J.

² Research Division, The New Jersey Zinc Co. (of Pa.), Palmerton, Pa.

³ 1939 Book of A.S.T.M. Standards, Part II, p. 810.

tem is highly arbitrary and in consequence may be subject to criticism. However, it has been found very useful in studying and presenting relative film failure data.

The final exposure data showed an extremely wide range in integrity failures within each of the six ten-panel sets. In fact, this range was so wide that an exposure test consisting of only one panel of each paint would have a very poor chance of showing the same relative order of durability as that obtained by averaging the results of the ten tests of each paint.

TABLE I.—SUMMARY OF ACCELERATED DURABILITY RATINGS.

	Best Panel	Poorest Panel	Average of Ten Panels
Series No. 1			
Paint No. 1	10	236	142.8
Paint No. 2	28	244	152.0
Paint No. 3	14	206	111.0
Series No. 2			
Paint No. 1A	138	272	211.7
Paint No. 2A	58	177	112.5
Paint No. 3A	57	221	105.9

Referring to Table I, if for example the best panel of paint No. 1 had been compared with the poorest panels of paints Nos. 2 and 3, paint No. 1 would have been rated decidedly superior to the other two paints in durability while actually it is intermediate between them. Just the opposite conclusion would have been arrived at if the poorest panel of paint No. 1 had been compared with the best panels of paints Nos. 2 and 3. Also, if the best panels of paints Nos. 2A and 3A had been compared with each other, the conclusion would have been drawn that these two paints are equal in durability, while a comparison of the poorest panels would have resulted in rating paint No. 2A definitely better than paint No. 3A. The averages of the ten-panel sets, however, rate paint No. 3A slightly better than paint No. 2A. Moreover, paint No. 1A which rates poorest, considering either the six best panels, or the six poorest panels, or the averages, could be made to rate best by a selection of panels.

TABLE II. STATISTICAL ANALYSIS OF DURABILITY RATINGS.

Series No. 1

56 per cent of the tests showed paint No. 1 better than paint No. 2.
37 per cent of the tests showed paint No. 1 better than paint No. 3.
33 per cent of the tests showed paint No. 2 better than paint No. 3.

Series No. 2

6 per cent of the tests showed paint No. 1A better than paint No. 2A.
4 per cent of the tests showed paint No. 1A better than paint No. 3A.
39 per cent of the tests showed paint No. 2A better than paint No. 3A.

On the basis of these results, the chances do not seem very good that an accelerated weathering test involving only one panel each would yield a reliable and approximately correct evaluation of the durability of a series of paints of similar weathering characteristics. An approximate idea of the possibility of securing a reliable result with single comparisons is obtained from Table II.

It would seem then that in order to obtain a correct evaluation of the relative quality of a series of paints by accelerated weathering it would be necessary to test a large number of panels simultaneously and average the results obtained, unless it should be possible to isolate and eliminate the factor or factors responsible for this wide variation.

In an effort to find an explanation for this variation in durability, the panels were examined for structural differences, which are known to exert considerable influence upon the durability and failure characteristics of paints.⁴ After cutting thin sections from the ends of the panels and sanding them smooth to make the wood grain more clearly visible, the panels were examined to determine whether there was any correlation between the degree of failure and the structural characteristics of the wood. The results of this examination are given in Table III.

TABLE III.—THE RELATIONSHIP BETWEEN PAINT FAILURE AND VARIOUS WOOD CHARACTERISTICS.

	Average Failure Grading	Average Grain Angle, deg.	Average Panel Density, g. per cu. cm.	Number of Summer Bands per Inch at Painted Surface
Three best panels.....	64	61.0	0.38	23.5
Four intermediate panels.....	146	68.0	0.38	23.0
Three poorest panels.....	206	78.0	0.38	22.0

As shown in Table III the average values of wood density and summerwood band concentration were the same for the three groups of test panels, while the grain angle increased with increasing degree of failure. The grain angle varied appreciably although all of the panels had been cut from edge grain red cedar wood selected according to the present A.S.T.M. specifications. The correlation between degree of failure and degree of deviation of the grain angle from the normal to the painted surface was surprisingly good. This correlation is illustrated in Figs. 1 and 2 and especially clearly in Figs. 3 and 4 which show both the grain and the film failures. The degree of failure increased as the grain angle approached normality with the painted surface. This relationship is not believed to extend much beyond the grain angle limits covered by these panels because of the well-known observation that flat grain panels cause more rapid paint failures than do edge grain panels of the same wood.

⁴ F. L. Browne:

"Properties of Wood that Determine the Service Given by Exterior Paint Coatings," *Official Digest*, No. 95, April 1930, pp. 106-115.

"Testing House Paints for Durability," *Journal of Chemical Education*, Vol. 10, pp. 529-538 (1933).

"Why Some Wood Surfaces Hold Paint Longer than Others," *Leaflet No. 62*, U. S. Department of Agriculture (1930).

"Developments in the Stabilization of Painting Practice for Wood," *Transactions, Am. Soc. Mechanical Engrs. (Wood Industries)*, Vol. 53, pp. 53-57 (1931).

Although the correlation between angle of grain and degree of paint failure was not perfect, it seemed reasonable to conclude that the reproducibility and reliability of accelerated weathering tests might be considerably improved by the use of test panels carefully matched with respect to uniformity of wood grain angle and density. To test this idea three groups of ten edge grain red cedar panels (3 by 6 in.), matched as well as possible for grain angle and density, were selected from a stock of several hundred panels. They were painted with three coats of paints Nos. 1, 2, and 3 used in the previous investigation. Exactly the same procedure was followed with respect to panel painting, exposure, examination, grading, and presentation of data as had been used previously.

It must be pointed out here that between the time the first and second accelerated tests were made on paints Nos. 1, 2, and 3, the weathering cycle was modified. This change resulted in less severe cracking and more checking failures, and represented a closer approach to the types of failure characteristic of these paints under outdoor exposure conditions. A comparison of Figs. 3 and 6 shows this difference in the failure patterns. This, however, in no way affects the conclusions arrived at on the basis of these experiments.

Figures 5 and 6 show quite convincingly that by selecting the accelerated weathering test panels for uniformity of grain angle and density the variations in the degree of failure of a given paint are greatly minimized and the reproducibility of durability evaluations may be materially improved. This improvement is perhaps more clearly shown in Table IV.

TABLE IV.—SUMMARY OF ACCELERATED DURABILITY RATINGS OBTAINED WITH MATCHED AND UNMATCHED PANELS.

Paint	Type of Panel	Film Failure Ratings		
		Best Panel	Poorest Panel	Average of Ten Panels
No. 1	Unmatched	10	236	143
	Matched	169	297	249
No. 2	Unmatched	28	244	152
	Matched	144	210	169
No. 3	Unmatched	14	206	111
	Matched	147	196	171

While it was estimated that the probability that an exposure test using unmatched panels and consisting of only one panel per paint under test would show the same relative order of durability as that obtained by averaging the results of ten tests on each paint would not be better than 1:10 to 1:15, it appears that this probability becomes approximately 1:2 by the use of matched panels. The probability of obtaining the correct evaluation by a single panel test increases as the differences in weathering characteristics between the paints under test become greater. Although the improvement realized by the use of matched panels is appreciable and well worth while, the data presented in this report indicate that other factors not yet identified and isolated are still in operation. Anticipating that similar conditions apply, the effect of this phenomenon on the reproducibility and reliability of exterior panel exposure tests is under investigation.

PAINT NO. 1		PAINT NO. 2		PAINT NO. 3	
PANEL NO.	FILM FAILURE	PANEL NO.	FILM FAILURE	PANEL NO.	FILM FAILURE
2	10	8	28	6	14
5	10	34	44	9	14
1	24	40	64	12	40
20	138	15	114	32	70
37	162	22	168	28	106
13	186	18	178	36	138
11	208	26	208	23	146
24	226	7	228	16	180
30	228	25	244	14	196
29	236	33	244	38	206

Fig. 1.

PAINT NO. 1A		PAINT NO. 2A		PAINT NO. 3A	
PANEL NO.	FILM FAILURE	PANEL NO.	FILM FAILURE	PANEL NO.	FILM FAILURE
69	138	68	58	76	57
50	149	81	88	42	74
41	173	80	92	48	75
51	178	65	99	70	84
44	226	83	99	43	87
59	230	47	106	66	100
75	241	72	120	74	109
55	254	77	136	60	123
64	258	46	150	49	129
67	272	54	177	56	221

Fig. 2.

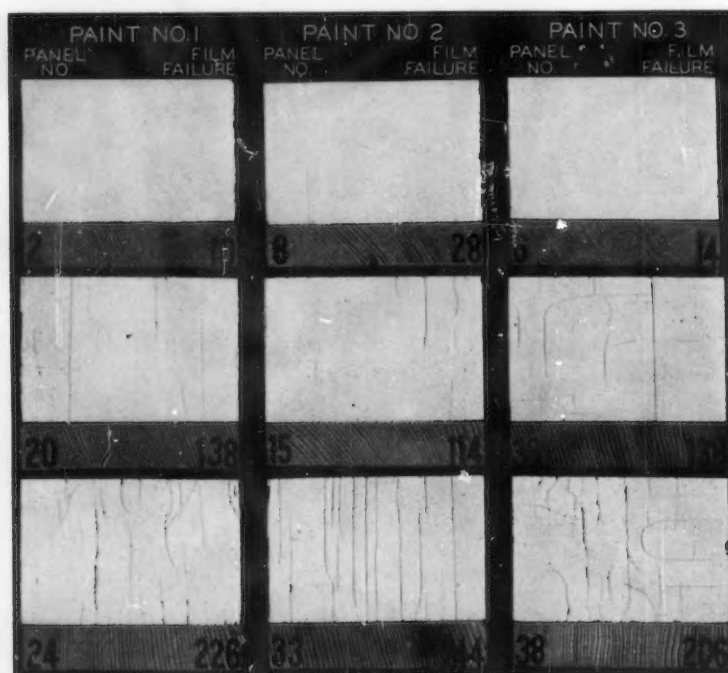


Fig. 3.

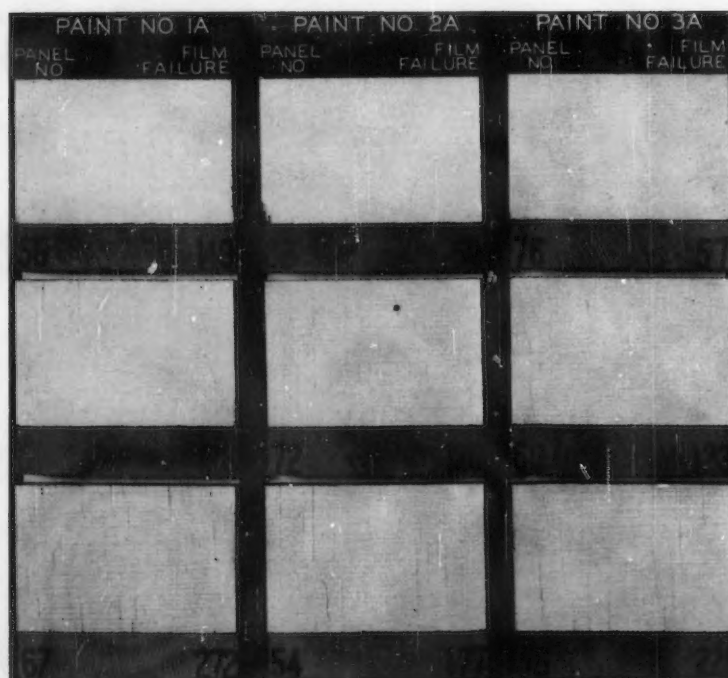


Fig. 4.

PAINT NO. 1		PAINT NO. 2		PAINT NO. 3	
PANEL NO.	FILM FAILURE	PANEL NO.	FILM FAILURE	PANEL NO.	FILM FAILURE
115	169	113	144	103	147
109	180	114	146	108	150
93	233	88	147	81	159
105	236	106	150	110	162
91	239	118	161	98	173
83	278	84	169	82	175
99	284	120	172	117	176
86	287	97	192	104	182
96	289	102	199	87	186
100	297	89	210	94	196

Fig. 5.

PAINT NO. 1		PAINT NO. 2		PAINT NO. 3	
PANEL NO.	FILM FAILURE	PANEL NO.	FILM FAILURE	PANEL NO.	FILM FAILURE
115	169	113	144	103	147
109	180	114	146	108	150
93	233	88	147	81	159
105	236	106	150	110	162
91	239	118	161	98	173
83	278	84	169	82	175
99	284	120	172	117	176
86	287	97	192	104	182
96	289	102	199	87	186
100	297	89	210	94	196

Fig. 6.

DISCUSSION

MR. F. L. BROWNE¹ (*by letter*).—Mr. Kittelberger's paper shows very clearly that the reproducibility of paint tests on wood can be improved by further selection beyond that provided by purchase under A.S.T.M. Specifications for Wood to Be Used as Panels in Weather Tests of Paints and Varnishes (D 358-38).² It does not follow, however, that the fact, which was known to the committee before the specification was offered, throws "considerable doubt upon the adequacy of the limits fixed by these specifications." Moreover the conclusion that "the degree of failure increased as the grain angle approached normality with the painted surface" is anomalous and the extent to which it is justified by the data presented requires further examination.

The excellent degree of selection for uniformity of wood structure exhibited by Fig. 5 was achieved by choosing 30 panels from "a stock of several hundred panels." This stock to begin with had been purchased under Specifications D 358-38 and therefore represented a severe degree of selection from the highest grade of lumber recognized in commerce. A narrowing of the specification to admit only such material as that of Fig. 5 would be practicable, if practicable at all, only at an expense that would be considered prohibitive by most laboratories. Since a good specification is usually a compromise between technical ideals on one hand and commercial availability on the other, the latter part of the problem should be considered adequately before drawing the conclusion that Specifications D 358-38 are unsatisfactory. Certainly deliveries under the specifications should not be used at random for work of high precision, but all material delivered under the specifications should be usable with a high precision provided that careful matching is practiced and particularly if the sets of matched panels are linked together by repetition of paint "controls."³

As a rule the easiest method of matching is use of neighboring parts of one board provided that the board is fairly uniform in character throughout its length. Study of Fig. 5 indicates that this method was used at least in part in Mr. Kittelberger's later tests, whether intentionally or accidentally. For example, repetitions of characteristic series of spacings of the annual rings show clearly that panels 113, 114, 106, and 118 were cuttings from the same board, and panels 97, 102, and 89 likewise came from one board, though perhaps a different one.

When test panels have already been cut to size and shuffled in handling they can be matched by selecting them for uniformity in density, ring count, and ring angle. Mr. Kittelberger reports that the panels shown in Fig. 5 were selected for "uniformity of grain angle and density" but comparison with Figs. 1 and 2 shows that they were selected also for ring count. In Figs. 1 and 2 the number of growth rings intersecting the painted surface varies from 13 to 45 per inch whereas in Fig. 5 it varies only from 18 to 28 per inch. The selection for ring count may have been entirely accidental because it will be shown later

that ring count and ring angle happened to be related among the panels of the stock in question.

Even among the panels of Fig. 5, however, there was still a small variation in paint durability which paralleled and is therefore largely explained by the slight remaining variation in ring count, inasmuch as density and ring angle were both practically constant. In the set of panels with paint No. 1 the five best panels range from 21.0 to 23.7, average 22.7 rings per inch, the five poorest panels from 19.7 to 21.7, average 20.7 rings per inch. For the set with paint No. 2 the five best panels range from 21.7 to 23.7, average 22.3, and the five poorest from 18.0 to 20.7, average 19.7 rings per inch. For the set with paint No. 3 the five best panels range from 22.7 to 28.0, average 25.0, and the five poorest from 18.3 to 27.0, average 22.7 rings per inch.

Mr. Kittelberger concludes from Table III that the variations in paint durability in his earlier tests arose from variations in ring angle because density and ring count were "the same for the three groups of test panels." The ring count, however, is reported as 23.5 for the best panels, 23.0 for the intermediate panels, and 22.0 for the poorest panels. When these counts, which were taken along the painted surface, are divided by the sines of the corresponding ring angles to obtain the true ring count, which is measured along the radius of the tree, the results are 26.9 for the best panels, 24.8 for the intermediate panels, and 22.5 for the poorest panels. The variation in ring count, therefore, is proportionally greater than the variation in ring angle. Furthermore the direction of trend in ring count, namely, higher count for the better panels, accords with the basic principles connecting wood structure with paint behavior whereas the direction of trend in ring angle runs counter to those principles and is therefore anomalous.

The data lead properly to the following conclusions: Among the panels of the particular stock with which Mr. Kittelberger worked, ring count tended to increase as ring angle decreased. This relation was presumably fortuitous and might be reversed in another stock of panels. The variation in paint durability within this stock of panels was determined primarily by ring count because the density was essentially constant and ring angle was confined to a region of high angles within which variation in ring angle is of little consequence.

F. M. Farmer Discusses Standardization

IN HIS ADDRESS presented at the retiring president of the American Institute of Electrical Engineers at the A.I.E.E. annual meeting held at Swampscott, Mass., June 24, 1940, F. M. Farmer, Vice-President and Chief Engineer, Electrical Testing Laboratories, discussed "Standardization and the Institute." He reviewed briefly the standardization movement and discussed the participation of the Institute in this movement. Mr. Farmer for many years has been extremely active in the work of A.S.T.M., is a past-president, and has taken a leading part in the work of the American Standards Association.

¹ Senior Chemist, Forest Products Laboratory, Maintained by the Forest Service, U. S. Department of Agriculture, at Madison, Wis., in cooperation with the University of Wisconsin.

² 1939 Book of A.S.T.M. Standards, Part II, p. 810.

³ *Industrial and Engineering Chemistry*, Vol. 25, p. 835 (1933).

Mr. Farmer's complete presidential address would be of interest to a large number of A.S.T.M. members. It appears in the October issue of *Electrical Engineering*. Some of the statements in his address are excerpted below.

"In commerce, industry, and engineering, the term 'standardization'—that is, the establishing of standards—may be described broadly and briefly as the codification of established or desired practices. These range from simple units of measure to specifications for materials and standards of industrial practices. . . ."

"In engineering and the allied sciences, standardization is a first essential in the orderly development of scientific and engineering knowledge for the benefit of mankind. It is self-evident, for example, that without standards of measurement of the various physical quantities with which the scientist and engineer deal interchange of new knowledge would be greatly restricted; no 'yardsticks' would be available for determining the amount of progress that is being made; and the application of new knowledge to useful purposes would be seriously hampered."

"A criticism of standardization occasionally heard is that, because standards of measure are permanent, stable, and uniform, therefore standards in engineering and industry must tend to exert a regimenting influence and to retard progress by "freezing" current practice. The evidence on every hand and the rapid extension of standardization in recent years refute any such contention. It is quite true that standardization can have a retarding influence if it is not carried on in a manner which will permit prompt revision of standards when circumstances so require. There is seldom, however, any valid reason why prompt revisions cannot be made."

SPECIFIC PURPOSES OF STANDARDS

"The various specific purposes of standards in science, engineering, industry, and commerce, those fields with which we are principally concerned, may be summarized briefly as follows:

1. To facilitate the interchange of knowledge through the standardization of terms, definitions, abbreviations, etc.
2. To facilitate buying and selling by means of purchase specifications which eliminate misunderstandings and controversies and place competitors on the same basis.
3. To facilitate and reduce the cost of production. This comes about, first, because standards, in the form of specifications for raw materials based on research and experience, insure that the final product, which may not be completed for months or perhaps years, will serve its intended purpose satisfactorily; and second, because manufacturing standards are a vital factor in modern mass-production methods which are so essential for low costs.
4. To reduce the cost of production, distribution, and utilization through simplification—that is, standardization on fewer sizes, shapes, kinds, and styles by elimination of those which are not really necessary.
5. To reduce human as well as economic waste through safety codes.
6. To improve conditions in the service branches of industry (as distinguished from manufacturing) through recommended-practice standards."

Committee on Standards Approves Several Revisions as of November 5

BY UNANIMOUS action, the Society's Committee E-10 on Standards on November 5 approved revisions in the following standards and tentative standards. The various recommendations are listed below:

- Revision of Tentative Methods of Test for Local Thickness of Electrodeposited Coatings on Steel (A 219 - 39 T) (*Committee A-5 on Corrosion of Iron and Steel*)
- Withdrawal of Standard Definitions of Fireclay and Alumina-Diaspore Refractories (C 27 - 39) and publication as tentative of the revised Classification of Fireclay Refractories (*Committee C-8 on Refractories*)
- Tentative Revision of Standard Method of Test for Pyrometric Cone Equivalent of Refractory Materials (C 24 - 35) (*Committee C-8*)

Tentative Revision of Standard Method of Panel Test for Resistance to Thermal and Structural Spalling of Refractory Brick (C 38 - 36), of High Heat Duty Fireclay Brick (C 107 - 40), and of Super Duty Fireclay Brick (C 122 - 40) (*Committee C-8*)

Revision of Tentative Method of Quantitative Spectrochemical Analysis of Zinc Alloy Die Castings for Minor Constituents and Impurities (E 27 - 37 T) (*Committee E-2 on Spectrographic Analysis*)

While the changes in the test for thickness of electrodeposits involve some rephrasing and re-editing, primarily the change concerned the use of hydrochloric acid with specific gravity of 1.18 instead of the 1.19 previously required in making the spot test for thickness of chromium. The latest requirement is more in line with the type of acid available and will make it much more convenient for users of the method to obtain the acid. While this change emanated from Committee A-5, Committees B-3 on Corrosion of Non-Ferrous Metals and Alloys and B-6 on Die-Cast Metals and Alloys to whom this change was referred are in agreement with the sponsoring committee.

Changes in the methods of spectrochemical analysis of zinc alloy die castings involve certain corrections and the inclusion of alternate procedures that have been found advisable since the method was first issued. The method covers determination of impurities such as iron, lead, cadmium, and tin in certain of the die-cast alloys given in the Specifications for Zinc-Base Alloy Die Castings (B 86 - 38 T), and also copper and magnesium in certain of the alloys.

With the acceptance of the Tentative Classification of Fireclay Refractories (C 27 - 40 T), the Committee on Refractories has acted to drop the Standard Definitions C 27 since they are no longer necessary. The new classification is intended principally to group fireclay refractories according to their resistance to heat and describes super-duty, high-heat duty, intermediate heat duty fireclay brick, with various methods of testing given. Revision of the test for pyrometric cone equivalent incorporates certain recommendations intended to satisfy the need for certain uniform test cones of the smaller size. Changes in the panel test for resistance to spalling resulted from cooperative work with the Refractories Fellowship at Mellon Institute, and among other things involves improved designs for the backup insulation used during the preheating period.

With the exception of the last change listed all will be incorporated in the 1940 Supplements to the Book of Standards. In the two cases where the revisions are tentative only, since they involve standards, they will be published in the section appearing in the back of the Supplements devoted to tentative revisions published for a year or more prior to adoption.

The revised Method of Quantitative Spectrochemical Analysis of Zinc Alloy Die Castings for Minor Constituents and Impurities (E 27 - 37 T) is being published in separate pamphlet form and a copy will be furnished on request without charge to all members of the Society and those who have purchased the Volume on Chemical Analysis of Metals, which is the bound publication in which this standard appears. Extra copies of this revised supplementary method (E 27 - 40 T) can be purchased at 25 cents each.



DECEMBER 1940

NO. 106

TWO-SIXTY
SOUTH BROAD ST.
PHILADELPHIA, PENNA.

Specification Writers as Salesmen

THERE IS NO QUESTION but that if every engineer and technical man who is engaged in developing standard specifications and tests—whether covering dimensional matters or quality—would devote a small percentage of the time expended in standards work to promote the use of specifications in which he has cooperated, the standardization movement might be much further ahead than it is. By no means is this an admission that the use of standards has been creeping along. As a matter of fact, the reverse is true and never more true than right now when the intensive activity on all fronts emphasizes the value and importance of standards.

While it may seem to be asking a great deal of otherwise busy men to suggest that those who are in the thick of standardization work should in addition be salesmen of the results of their efforts, it is not at all unusual to find that one concerned with production is also a good salesman. One thoroughly familiar with the development of a product or a standard knows the fundamental facts and details better than one who has not been exposed to the situations involved.

We believe that if the technical men and engineers individually will devote a bit more thought and somewhat more effort to selling, the A.S.T.M., industry, Government, and everyone, will be better off.

When Is a Producer a Consumer?

MORE THAN ONE technical executive has damned his customers and probably competitors for their lack of interest in using sound specifications or possibly for not using any specifications at all. We wonder how many of these persons have investigated the use by their own company of specifications in the purchase of materials they need. There are very few companies which do not need to purchase some materials or products outside of their own organization.

While the number of producers who use standards in buying is no doubt large, the importance of this factor in advancing standardization is frequently lost sight of.

Perhaps the answer to the question at the head of this article is: A producer is a consumer when he is buying materials he needs; but in the matter of specifying by the uses of standards . . . he may not be standards conscious.

From the President

THE THANKSGIVING SEASON has but recently passed and Christmas and the New Year are approaching. There is much for which we may be thankful, both as an organization and as individuals. It has been a year of activity and accomplishment. The Society has enjoyed a satisfactory growth, the scope of the work has been extended, and our prestige increased. More important than this, we have been permitted to pursue our varied lines of work in a country at peace. Our greatest concern for the future is to direct our efforts toward the maintenance of that peace. With this purpose we are cooperating with other technical groups in the interest of national defense and doing all within the power of our organization to protect that peace without which progress is impossible.

The season's greetings are extended to all with the hope that the coming year will be one of happiness and progress.

Sincerely,

President.

Our use of the term "producer" applies to almost everybody. Some organizations usually thought of as "ultra-producers" may more likely be "ultra-consumers." Conversely, "ultra-consumers" may frequently be very extensive producers.

Promoting Knowledge of A.S.T.M.

THE PERCENTAGE of members engaged in advancing the work of the Society along lines of standardization and research is very high. In fact, few volunteer organizations can boast of so active a group. But committee activities, even though fundamental, are not the only means of assisting in promoting A.S.T.M.; many members help in membership work, in arranging meetings, and the like.

There is a still further activity which not only indirectly helps the Society, but also affords a solution to a problem frequently confronting engineers and technologists, namely, using the Society as the basis of a talk. "A.S.T.M." can be the answer to the question, "What can I talk about?"

Our organization is unique in many respects. First of all, it is a meeting ground where consumers and producers discuss their problems and iron out conflicting viewpoints. It has stressed for almost four decades the importance of quality standards. Probably no other live national group has been in this field so long and with such results. The A.S.T.M. committee setup is unique as is also the rigorous method of ascertaining that there is a consensus on a standard. Much of our research is of broad interest—sea-water corrosion, high-temperature tests, moth tests.

Any member who would like to have some information about the Society which can be developed into a talk should write A.S.T.M. Headquarters. Extending knowledge of the Society, of specifications, and of needed research among business men and others is very important.

Progress in Membership

MEMBERSHIP GROWTH during 1940 has been most gratifying. An analysis made on November 15 showed 371 new members elected and 241 losses from death, resignations, and delinquency—a net gain of 130 which brings the total membership to 4341. This is substantially better than in either of the two preceding years, which is to be expected in view of the increase in industrial activity and the resulting emphasis upon tests and specifications for materials.

Undoubtedly the wide distribution of the 1939 edition of the Book of A.S.T.M. Standards has in itself served to emphasize the present-day importance of the Society's work and to attract new members.

But the most effective means of membership growth has been, as always, the personal interest of so many of our members in the welfare of the Society and their desire to have the benefits and values of a membership in A.S.T.M. shared by their friends and associates in engineering and industrial circles.

For all that our members have done in helping to build up Society membership, our sincere and hearty thanks!

Another very gratifying feature of the 1940 membership picture is the substantial increase in sustaining membership. Starting the year with 29 such members, we are closing with 108, or an increase of 79—64 by transfer from company membership and 15 new memberships. And there are already six additional sustaining memberships to begin January 1, 1941, with more to come. The favorable reception that this form of membership, at annual dues of \$100, has had among the companies who are actively engaged in A.S.T.M. work and appreciate its great industrial and technical values, is one of the inspiring developments of the 1940 membership year. The increased income from sustaining memberships has materially strengthened the Society's financial position, and made possible needed expansion of the staff to care for rapidly increasing work in the development and publication of standards.

We look ahead to 1941 confident that the year will be full of valuable accomplishments in all those things for which A.S.T.M. stands. Membership in the Society steadily grows in its benefits to both individual and company.

Each member can help to spread these benefits and enhance the prestige and usefulness of the Society's work by telling someone else about it and inviting them to consider membership. To this end, we are sending to each member in a separate mailing an application blank for membership.

Will you place it in the hands of some person who should be engaged in the work of A.S.T.M.?

C. L. W.

Publishing A.S.T.M. Standards in Spanish

THE DEVELOPMENT of closer relations with our South American neighbors is reflected in the translation of a number of A.S.T.M. standards into Spanish. One group of 13 standards on refractories is being issued through the interest of the American Refractories Institute. This special compilation will be distributed by the Institute, particularly among a large number of South American organizations where interest in the refractories field has been very keen.

Evidence of the interest in South American countries in specifications and tests standardized in this country is shown by publication of a number of petroleum standards by the Argentine Government Oil Fields, these translations appearing currently in the *Boletín de Informaciones Petroleras* (Argentine). The Portland Cement Institute of Argentina has asked permission to publish a Spanish edition of the Report of the Joint Committee on Concrete and Reinforced Concrete, and this permission has been granted by the Societies sponsoring the committee.

A number of years ago through the interest and activity of the Bureau of Foreign and Domestic Commerce quite a number of A.S.T.M. specifications and tests were published in foreign languages.

There is no question of the growing interest in the work of the Society by South and Central American countries, and having the Spanish and possibly Portuguese translations of standards available will, of course, encourage this interest.

Registration of A.S.T.M. Seal

RECENT DISCUSSIONS have indicated the desirability of having the A.S.T.M. seal registered in the U. S. Patent Office as a trade mark and on October 18, 1940, an official certificate of registration was received from the Patent Office. It will be noted from the table of contents in this BULLETIN, page 1, that the phrase "Reg. U. S. Pat. Off." appears in conjunction with the seal. It is planned that each Society book, in the future, will carry on the title page this notice of the registration of the seal. This will make clear to everyone that it is to be used exclusively by the Society or by permission only.

Joint Work on Heat Treatment Terms

AS A RESULT of joint discussion of the subject of definitions of terms relating to heat treatment by the Society of Automotive Engineers, American Society for Metals and A.S.T.M., the desirability of reconstituting the former joint committee on this subject has been indicated. Accordingly, the three sponsor groups have appointed representatives. As seen from the committee personnel which follows, Messrs. Fuller, Fry, and Rawdon will act for the Society, Mr. Fuller having been appointed chairman of the A.S.T.M. delegation.

Some studies are expected to be instituted in certain of the Society standing committees which are concerned with heat treatment terminology, particularly Committee A-1 on Steel in which a new Subcommittee XXIV on Heat Treatment of Steel has been appointed. It is expected that this group will be formally organized in January.

PERSONNEL OF JOINT COMMITTEE

Representing Society of Automotive Engineers:

J. R. Adams, The Midvale Co.
Hyman Bornstein, Deere and Co.
R. B. Schenck, General Motors Corp.

Representing American Society for Metals:

R. F. Mehl, Carnegie Institute of Technology
C. H. Mathewson, Yale University
R. H. Aborn, United States Steel Corp., Research Laboratory

Representing American Society for Testing Materials:

T. S. Fuller, General Electric Co.
L. H. Fry, Edgewater Steel Co.
H. S. Rawdon, National Bureau of Standards

Offers of Meeting Papers by February 1

COMMITTEE E-6 ON PAPERS AND PUBLICATIONS is extending to each member of the Society the customary invitation to offer papers for presentation at the 1941 annual meeting in Chicago on subjects relating to the properties and testing of engineering materials.

In order that as many as possible of the technical papers and committee reports can be preprinted in advance of the meeting, it is desirable that the program be developed early. Committee E-6 has fixed February 1 as the limiting date for receipt of offers but members who may be considering the submission of a paper are urged to send their offers to A.S.T.M. Headquarters *as soon as possible*. Suitable blanks which should be used in sending the necessary information with respect to the offer of a paper can be obtained from the Society offices. Each offer must be accompanied by a summary of the proposed paper in such detail that its scope is clear and also to point out features that in the author's opinion make the paper a desirable one for presentation and discussion.

Invitations to submit papers are not limited to A.S.T.M. members, many outstanding technical contributions to our *Proceedings* having been made by men who were not affiliated with the Society.

Society Appointments

Announcement is made of the following Society appointments:

G. H. HARNDEN, General Electric Co., on the Joint A.S.T.M.-T.A.P.P.I. Committee on Paper Testing Methods, succeeding L. S. REID, Metropolitan Life Insurance Co.

T. G. STITT, Pittsburgh Steel Co., on A.S.A. Sectional Committee B36 on Standardization of Dimensions and Materials of Wrought-Iron and Wrought-Steel Pipe and Tubing, succeeding F. N. SPELLER, Consulting Metallurgical Engineer, Pittsburgh, Pa.

H. R. REDINGTON, National Tube Co., on A.S.A. Sectional Committee B31 on Code for Pressure Piping, in place of F. N. SPELLER.

H. J. BALL, Lowell Textile Institute, as an A.S.T.M. representative on Advisory Committee on Ultimate Consumer Goods, with R. E. HESS, Assistant Secretary, as alternate.

L. J. TROSTEL, General Refractories Co. Laboratories; E. P. PARTRIDGE, Hall Laboratories, Inc.; and A. J. PHILLIPS, American Smelting and Refining Co., as members of Committee E-1 on Methods of Testing for terms of 3 yr.

J. R. FREEMAN, JR., American Brass Co.; C. E. HBUSSNER, Chrysler Corp.; STANTON WALKER, National Sand and Gravel Association (reappointed) as members of Committee E-6 on Papers and Publications, for terms of 3 yr.

M. E. HOLMES, New York State College of Ceramics; G. B. WATERHOUSE, Massachusetts Institute of Technology (reappointed) as members of Committee E-8 on Nomenclature and Definitions for terms of 3 yr.

ARTHUR W. CARPENTER, The B. F. Goodrich Co., as a member of Committee E-9 on Research for a term of 5 yr.

N. L. MOCHEL, Westinghouse Electric and Manufacturing Co., and J. R. TOWNSEND, Bell Telephone Laboratories, Inc., as members of Committee E-10 on Standards for terms of 3 yr.

B. S. VAN ZILE, Colgate-Palmolive-Peet Co., and F. S. MAPES, General Electric Co., on the recommendations of Committees D-12 on Soaps and Other Detergents and D-13 on Textile Materials, respectively, as non-voting delegates on the Inter-Society Color Council.

C. J. HUBER, United States Testing Co., as a non-voting delegate on the Inter-Society Color Council.

R. W. CRUM, National Research Council, as the Society's representative on the American Documentation Institute.

Schedule of Meetings

DATE	COMMITTEE	PLACE
January 13, 14	A-1 on Steel.....	Philadelphia, Pa.
January 13, 14	D-2 on Petroleum...	Detroit, Mich.
January 20, 21	Executive Committee	Philadelphia, Pa.
December 3...	St. Louis District Meeting.....	St. Louis, Mo.
March 3-7...	Spring Meeting and Committee Week..	Washington, D. C.
June 23-27...	Annual Meeting and Sixth Exhibit....	Chicago, Ill.

Student Members Total 479

LATEST INFORMATION on student membership shows a total of 479 student members from some 42 leading technical schools and universities. A large proportion of this number is located at 18 schools. A list of those with five or more student members include the following: College of the City of New York, Ohio State University, University of Alabama, University of Delaware, Cornell University, Rensselaer Polytechnic Institute, University of Pennsylvania, University of Kansas, Detroit Institute of Technology, Grove City College, Iowa State College, Massachusetts Institute of Technology. In this group the College of the City of New York is far in the lead with 189 members, the Ohio State University being second with 75.

In a number of these schools, use is made of various A.S.T.M. publications, including the Book of Standards which is furnished to student members at a very considerable saving. A factor which influences to some extent student membership at certain schools is the Student Membership Prize Award Plan under which membership is awarded to students for notable work in certain fields, including testing laboratory, mechanics of materials, chemical engineering, etc. These awards are underwritten by interested members of the Society. A list of schools where the plan is in effect with the donors follows:

Cornell University.....	F. M. Farmer
Detroit Institute of Technology.....	F. O. Clements
Grove City College.....	A. E. Pew, Jr.
Iowa State College.....	H. P. Bigler
Massachusetts Institute of Technology.....	Arthur W. Carpenter
Rensselaer Polytechnic Institute.....	Herbert Spencer
University of Idaho.....	A. E. Peterson
University of Illinois.....	S. H. Ingberg
University of Kansas.....	Walter Bohnstengel
University of Pennsylvania.....	C. L. Warwick
Worcester Polytechnic Institute.....	S. Collier

The Society is definitely interested in having a large number of student members because in this way future engineers are acquainted with the value of A.S.T.M. work. In turn, the students receive valuable publications at very nominal charges (the *only* fee is \$1.50 yearly dues). For this they receive without charge a selection of any one of the nine compilations of A.S.T.M. standards (priced for members from 75 cents to \$1.50) or they can procure the "Selected A.S.T.M. Standards for Students in Engineering." The ASTM BULLETIN, Index to Standards, and preprints are furnished also.

Any member of the Society who wishes information on the Student Membership Prize Award Plan should write to A.S.T.M. Headquarters.

Philadelphia Meeting on Specifications

Use and Abuse of Specifications Discussed Informally

ONE OF THE MOST INTERESTING meetings sponsored by a Society district committee was held in Philadelphia at the Engineers' Club on Friday, November 15, under the auspices of the Philadelphia District Committee. The subject "Specifications—Their Use and Abuse" was a particularly timely one and the committee under the chairmanship of F. G. Tatnall, Baldwin-Southwark Division, The Baldwin Locomotive Works, did an excellent piece of work in stimulating interest in the meeting and getting out a really good attendance including many individuals who are not actively interested in A.S.T.M. work, but who are concerned with the general problem of quality of materials. Quite a number of men were present from various branches of the Government, a number participating in the discussion and adding a great deal to the interest in the meeting.

Various members of the district committee cooperated closely in making the necessary arrangements. E. J. Albert, General Manager, Thwing-Albert Instrument Co. was in charge of the dinner and related items; Judson Vogdes, Engineer, Glen Gery Shale Brick Corp., handled invitations, publicity, and general promotion; Vice-Chairman L. E. Ekholm, Metallurgical Engineer, Alan Wood Steel Co., assisted with the technical program and Secretary R. W. Orr, Engineering Department, RCA Victor Division, RCA Manufacturing Co., Inc., cooperated all along the line. The work of these men was responsible for an excellent attendance; there were some 135 at the dinner with approximately 300 at the technical session.

TECHNICAL SESSION

In opening the technical session of the meeting, Chairman Tatnall called on the Secretary-Treasurer, C. L. Warwick, who welcomed the members and guests on behalf of the Society. He commented on the extensive interest in standardization work and discussed some of the contacts which have been made with various departments of the Government in Washington in connection with specification matters. He referred to the important part which A.S.T.M. plays in industrial activities and expressed a feeling that one of the most important contributions which the Society can make in time of national defense is to continue its work actively along all fronts. In concluding, he discussed one factor which is fundamental in all specifications activities, namely, the necessity of sound, authoritative data on the properties of materials, the development of which is one of the Society's major purposes. He referred to the detailed review of the more than 100 formal research projects being carried on under Society auspices as detailed in the October ASTM BULLETIN.

N. L. Mochel, Manager, Metallurgical Engineering, Westinghouse Electric and Manufacturing Co., Philadelphia, took over the meeting as the chairman of the technical session proper. He outlined the nature of the discussion and introduced the co-chairmen who were to preside during three specific phases of the session. Alexander Foster, Jr., Vice-President, Warner Co., Philadelphia, was in charge of the portion devoted to aggre-

gates, cementitious materials, and general structural materials; P. E. McKinney, Metallurgical Engineer, Bethlehem Steel Co., Inc., Bethlehem, of the part on metals; G. H. Mains, Chemical Engineer, National Vulcanized Fibre Co., Wilmington, Del., was co-chairman on plastics. In view of the wide extent of A.S.T.M. work, it was felt necessary to concentrate on these three specific fields in which there is pronounced interest in the Philadelphia area.

Each co-chairman called on certain individuals in the audience, several of them by previous arrangement, to present briefly their reactions on the various problems involved in the general philosophy of specifications, their use, kinks in connection with their development, and other factors. All told, about 25 took part in the discussion, not including the presiding officers. While it was agreed in advance that the remarks would be strictly "off the record," and no quotations would be made, some general statements of the nature of the discussion seem in order.

COMMENTS ON SPECIFICATIONS

Necessity of complete cooperation between the interests involved in a specification was expressed by one speaker who stressed also the desirability of cooperation between the various bodies and associations responsible for standardized requirements. In other words, a group concerned with dimensional standards, as distinct from quality requirements needs to work in harmony with a body writing quality standards, and the reverse is true. In many fields the two matters must be correlated. Selling a new specification was the theme of one speaker, who stressed that after much technical skill has been expended in evolving the best standard possible, the work will be partly wasted unless a determined effort is made to have all producers and consumers use the standard.

There were some comments that a closer study of scope clauses in A.S.T.M. specifications might be desirable in that some are not entirely adequate. They should perhaps state more clearly just what the specifications do or do not cover. While the question of including explanatory material in specifications has many proponents, obviously each A.S.T.M. specification cannot include within itself a general discussion of the applicability of the materials covered, design factors which are important, and other notes. Many specifications do carry explanatory notes and appended material which in the opinion of the committees responsible present pertinent data of an essential or quasi-essential nature. More detailed scope clauses would undoubtedly be desirable in many standards.

The question of having all interests participate in A.S.T.M. committee work was critically discussed by one member who stressed the need in certain fields of more active consumer participation. The speaker further pointed out that each group has the responsibility of seeing that its efforts do not tend to lessen the interest of the other groups. Since the value of the Society's work will be achieved only by widespread use of its standards

and the worthwhileness of the standards depends on their being satisfactory to *both* consumer and producer—each group must be represented adequately.

Considering the general field of plastics, mention was made of the basic difference between these materials of very complicated atomic structures, and other material, such as metals. This situation complicates specification writing because the conditions and environment of testing have to be standardized in so far as possible, since humidity, temperature, etc., have important effects. In this connection, mention was made of the fact that there were sometimes as many, and often worse, kinks in so-called private specifications than there might be in specifications developed by standardizing bodies, including so-called Government standards.

Representatives of producers mentioned the desirability of having information on the intended use of material, so that if it were definitely unsuited the matter could be discussed.

The question of specifying chemical requirements for metals, or physical requirements, or both, was discussed in a general way and the difficulties in using both physical and chemical properties were considered. It is scarcely reasonable to expect a producer to meet certain performance requirements if he is restricted too closely by process limitations. But in certain fields where the service is very severe, such as for high-pressure and high-temperature, Society committees have felt it necessary to incorporate both chemical and physical limitations.

Some of those present related difficulties in procuring materials required in carrying out certain contracts—finding the source of supply inadequate after having promises that the materials would be available—then learning no substitutes could be accepted. This condition could be remedied by having a specification for a finished product carry a list of two or three steels (if steel were the particular material involved) so that the machine or apparatus producers could carry on production without serious delay.

The all too frequent practice of postponing critical examination of specifications until they are in circulation, instead of developing constructive criticism while a proposed standard is in process of development, was decried. While these studies take time and effort they are amply justified. It was felt that "bugs" in a specification requirement could be removed a whole lot easier in the development stage than after they were flying around.

Aircraft Metallurgy at Chicago Meeting

UNDER THE JOINT auspices of the Chicago Chapter of the American Society for Metals and the A.S.T.M. Chicago District Committee, a meeting featuring a discussion on aircraft metallurgy was held on Thursday, October 10. Richard R. Kennedy, Metallurgist, War Dept., Air Corps, Materiel Division, Wright Field, was the principal speaker. Technical chairman of the meeting was E. R. Young, Metallurgical Engineer, Climax Molybdenum Co., and Chairman of the A.S.T.M. Chicago District Committee, who with C. E. Ambelang, Engineer, Public Service Co. of Northern Illinois, and Secretary, Chicago District Committee, handled arrangements for the A.S.T.M. participation in this meeting.

There were 198 present at the dinner preceding the meeting proper and some 350 were present during the discussion.

Mr. Kennedy, who has been at Wright Field for ten years, covered generally the development of aircraft, described some of the modern uses of materials, and made certain comparisons between the aircraft and automotive industries from the production standpoint. He also covered some of the reasons for the use of basic materials in aircraft construction including steel, aluminum, wood, etc. Following his talk, there was a general discussion and question period of about a half hour's length.

At the speakers' table during the dinner were, in addition to Chairman Young, the Society President, Dr. W. M. Barr, Chief Chemical and Metallurgical Engineer, Union Pacific Railroad Co., Major J. de N. Macomb, Assistant to Vice-President, Inland Steel Co., Chicago, and Vice-Chairman, Chicago District Committee; and J. F. Calef, Chief Chemist, Automatic Electric Co., Chicago, chairman of the Program Committee. Doctor Barr gave a brief talk covering some points of A.S.T.M. activities that would be of interest to those present and also pointed to the contribution which technical men can make in connection with the intensive activities going on at the present time.

Glass Discussed at New York Meeting

TWO OF THE COUNTRY'S outstanding authorities on glass spoke at the meeting sponsored by the New York District Committee on October 17 at the Hotel Pennsylvania—Dr. Games Slayter, Vice-President, Owens-Corning Fiberglas Corp., covered fiberglas and Dr. G. W. Morey, Geophysical Laboratory, Carnegie Institution of Washington, Chairman of Committee C-14 on Glass and Glass Products, discussed glass other than fiberglas.

Preceding the meeting, arrangements for which were made by Myron Park Davis, *District Committee Chairman*, and G. O. Hiers, *Secretary*, an informal dinner was held.

Past-President Cloyd M. Chapman presided at the technical session and introduced both speakers, as well as conducting the discussion. Following the discussions there was a very interesting question and answer period.

Doctor Slayter discussed the widespread applications of fiberglas and by means of an extensive display of various products very effectively demonstrated to his audience the many and varied uses of the material which include filters, various textile products, thermal insulation, electrical insulation, and the like.

Doctor Morey, whose assigned subject was a broad one, concentrated on certain features, in particular, some of the later developments including the possibilities of imparting different properties to glass with heat treatment and other processing practices. While he might have discussed the subject from a very scientific and theoretical angle because of his background, his presentation was definitely of interest to all of those present who came from quite a wide cross-section of industry.

This meeting was held at the time of the fall meetings of Committee D-13 on Textile Materials with a program designed to be of interest to this group. A number of textile technologists were present at the meeting. The attendance was about 150.

XXIV. Long-Time Society Committee Members

Twenty-fourth in the Series of Notes on Long-Time Members

As a continuation of the series of articles in the ASTM BULLETIN comprising notes on the outstanding activities of long-time A.S.T.M. members, there are presented below outlines of the work of three additional members. In general, the men whose activities are described in this series have been affiliated with the Society for 25 years or more and have taken part in committee work for long periods of time. No definite sequence is being followed in these articles.

MYRON PARK DAVIS, Chief Chemist and Metallurgist, Otis Elevator Co., Yonkers, N. Y., received his education at Allegheny College, Meadville, Pa. His first position was Assistant Chemist with the Standard Steel Works at Burnham, Pa. Following this he entered the employ of the Pennsylvania Railroad Co., serving under Charles B. Dudley, first President of the Society. Beginning in December, 1906, Mr. Davis was for three years assistant chemist in the Altoona laboratory and then until 1912 was chemist and metallurgist in charge of the Pennsylvania Railroad's South Altoona Foundries. He has been in his present position with the Otis Elevator Co. since 1912.

While he did not become officially affiliated with the Society until 1912, Mr. Davis from his association with Doctor Dudley was interested in the work and he attended his first meeting of the A.S.T.M. about 1907. He has continuously attended these meetings since that time.

Mr. Davis is very active in A.S.T.M. committee work. For many years he has represented his company on Committees A-3 on Cast Iron, D-2 on Petroleum Products and Lubricants, D-11 on Rubber Products, and D-20 on Plastics. He is a consulting member of the committee on coal and coke.

His longest and probably most intensive service has been as a member of Committee D-9 on Electrical Insulating Materials with which he has been affiliated since 1921. He is active in the work of a number of subcommittees, a member of its Advisory Committee and chairman of the subcommittee on mica products.

As chairman of the New York District Committee, Mr. Davis is rendering outstanding service in forwarding the interest of A.S.T.M. in the New York Metropolitan area.

In addition to his A.S.T.M. membership, he is a member of the American Chemical Society, American Society for Metals, and is associated with certain work of the American Foundrymen's Association on the Technical Sand Committee.

HENRY G. BURNHAM, Engineer of Tests, Northern Pacific Railway Co., with offices at St. Paul, Minn., is a native of Glens Falls, N. Y. He graduated from Cornell University, Class of 1906, with the degree of chemical engineer.

Following a period of service as Assistant Engineer of Tests with the Delaware, Lackawanna & Western Railroad and Engineer of Tests from 1909 to 1912 with the Buffalo, Rochester & Pittsburgh Railroad with headquarters at Du Bois, Pa., Mr. Burnham entered the employ of his present company and has held his present position since 1912. The next year he became affiliated with the Society as the representative of his company.



H. G. Burnham

C. A. Lunn

M. P. Davis

Mr. Burnham's principal committee activities have involved Committees A-1 on Steel, A-2 on Wrought Iron, and D-1 on Paint, Varnish, Lacquer, and Related Products. He has served continuously since 1913 as a member of the Steel group's Subcommittee IV on Spring Steel and Steel Springs and has been a member of Subcommittee XIII on Methods of Physical Tests since it was reorganized a few years ago. His activities in the wrought iron committee involve the subcommittee on tubes and pipe and the work on galvanizing in the charge of Subcommittee XI. In Committee D-1 he has served as a member of the subcommittee concerned with specifications for pigment.

In addition to his work in the Society, Mr. Burnham is associated with the work of the Association of American Railroads. His clubs include the St. Paul Athletic Club and the Midland Hills Country Club.

CHARLES A. LUNN, Technical Director, Consolidated Edison Company of New York, Inc., received his degree of Bachelor of Chemical Engineering from the University of Michigan in 1911. Prior to the participation of the United States in the World War, Mr. Lunn was connected with the wood distillation and extraction industry. During the war, he was First Lieutenant in the Army Ordnance Dept., Explosives Division.

His connection with his present company began in 1920 when he was Chief Chemist of the Consolidated Gas Co. Later he became chemical engineer of this company. When the gas company was consolidated into the present Consolidated Edison Company of New York, Inc., Mr. Lunn became Technical Director.

He has had a wide range of interest in the field of materials and has served the Society on a number of its standing committees. His earliest connections were with Committees D-1 on Paint, Varnish, Lacquer, and Related Products, and D-2 on Petroleum Products and Lubricants. He still is a member of D-2, serving on three of its subcommittees. For a number of years he was chairman of its subcommittees on gas absorbent oil, gas oil, and on application of tests. Mr. Lunn has served continuously as a member of Committee D-5 on Coal and Coke and has been active in a number of subcommittee projects. He was chairman of the group concerned with tolerances for a period of five years. At the present time he represents this committee on the Technical Committee on Presentation of Data of Committee E-1. Formerly, for a period of about

10 years he served on Committees A-10 on Iron-Chromium Nickel and Related Alloys and B-3 on Corrosion of Non-Ferrous Metals and Alloys and three of its subgroups.

In addition to the above work Mr. Lunn is serving the Society as a member of the New York District Committee. He is a member of a number of other societies and associations including the American Chemical Society, American Gas Association, American Institute of Chemical Engineers, Chemists' Club, Society of Gas Engineering of New York City, and Society of Gas Lighting.

Textile Committee Has Outstanding Meeting

THE REGISTERED attendance of 159, including 32 guests, at the regular fall meeting of A.S.T.M. Committee D-13 on Textile Materials held at the Hotel Pennsylvania, New York City, October 16 to 18, inclusive, was the largest of any meeting in the committee's history. In addition to the general session of the main committee at which subcommittee recommendations and reports were presented, there were sessions of the advisory committee, 24 of the 28 subcommittees, four special sections, and the research committee also held a meeting. An interesting paper session featured four contributions as follows:

"A Correlation Between Laboratory Abrasion Tests and the Service Life of Men's and Women's Outerwear"—Arthur Russman, Howard Manufacturing Co.

"New Synthetic Fibers"—H. R. Mauersberger, Technical Editor, Rayon Publishing Corp.

"Controlled Observations of the Rate of Deterioration of Fabrics in Consumer Use as a Measure of Their Relative Merit"—Alexis Sommaripa, E. I. du Pont de Nemours and Co., Inc.

"Comparison of the Breaking Strength of Fabrics as Determined by the Pendulum and Inclined Plane Testing Machines"—Gladys White and Emma C. Peterson, Bureau of Home Economics, U. S. Department of Agriculture.

The paper by Mr. Mauersberger is being published in the journal, *Rayon Textile Monthly*.

While the committee held no formal dinner this year, a number of the members joined with the New York District group in their informal dinner and subsequent meeting described in another portion of this BULLETIN, on the subject of glass and glass products.

RECOMMENDATIONS ON STANDARDS

The committee expects to recommend to the Society the following new tentative standards:

Method of Test for Asbestos Tubular Sleaving
Method of Test for Resistance of Fabrics to Fire
Specifications for Certain Cotton Corduroy Fabrics

Revisions were developed in a large number of standards, listed below. Full details of these changes will be listed in the committee report.

Methods for Identification of Fibers in Textiles and Quantitative Analysis of Textiles (D 276 - 37 T).
Methods of Testing and Tolerances for Continuous Filament Rayon Yarns (D 258 - 40).
Methods of Testing and Tolerances for Tubular Sleaving and Braids (D 354 - 36).
Method of Test for Fastness of Dyed or Printed Cotton Fabrics to Laundering or Domestic Washing (D 435 - 37).
Specifications for Single-Ply Bleached Cotton Broadcloth (D 504 - 38 T).
Method of Test for Fastness of Colored Textile Fabrics to Light (D 506 - 39).
General Methods of Testing and Tolerances for Spun Rayon Yarns and Threads (D 507 - 39).
Methods of Testing Rayon Staple (D 540 - 39 T).
Methods of Testing and Tolerances for Woven Glass Fabrics (D 579 - 40 T).
Methods of Testing and Tolerances for Woven Glass Tapes (D 580 - 40 T).

RESEARCH WORK

The following will give an idea of the large number of projects being carried on by the D-13 subcommittees:

Specifications for: Twist testers, drying ovens, abrasion machine for pile fabrics, dish toweling, and a variety of clothing fabrics.

Methods of test for: Commercial weight of rayon staple, wool content, plied jute yarns and single and plied jute rovings, degree of mercerization of fabrics, glass sliver, glass yarn number, binder-lubricants for glass filaments, abrasion of glass yarn and fabrics, pH test for glass, sensitivity of vertical pendulum testing machines, acceler-

"The Birth of Myriad Sun Glasses"

Awarded Honorable Mention in the Third A.S.T.M. Photographic Exhibit, by E. L. Hettinger, Willson Products, Inc.



ating aging of textiles, determination of twist, resistance of textiles to soiling, identification of permanent finishes.

Studies are being conducted on: Tension in twist determinations, physical standards for tire fabrics, standards for plain weave asbestos cloths, relationship of breaking strength to temperature of asbestos cloths, iron in asbestos, thickness methods, basic fiber properties, relationship of strength to rate-of-loading, drying out and conditioning techniques, regain in mixtures of textile fibers, and definitions.

The application of statistical methods for determining the number of tests required for a desired accuracy is spreading among the D-13 subcommittees. Several are conducting interlaboratory tests for this purpose. The recommended practice, published in the 1940 edition of the A.S.T.M. Standards on Textile Materials, is serving as a guide in this work.

Joint Committee on Effect of Temperature Reports Progress

AT THE MEETING of the Joint A.S.T.M.-A.S.M.E. Research Committee on Effect of Temperature on the Properties of Metals held at Battelle Memorial Institute on November 1 and 2, it was announced that solicitation of funds for continuing researches had been successful and that while some organizations who benefit from the work were not supporting it, most industrial organizations were rendering enthusiastic support.

This Joint Committee has various project groups responsible for specific research and investigative problems.

Project No. 10 is a most important one dealing with testing of tubular products at elevated temperatures, involving particularly the relationships of tubular and tensile creep. A valuable report on the results of this work which has been carried on at the Massachusetts Institute of Technology under the direction of Prof. John T. Norton was presented. A formal paper on the subject is to be part of the annual meeting program of the American Society of Mechanical Engineers (December 2 to 6, Hotel Astor, New York City).

Project No. 16 on relaxation tests, headed by E. L. Robinson, General Electric Co., is progressing and a paper sponsored by the group is to be presented at the December A.S.M.E. meeting on Thursday, December 5, by A. W. Wheeler, General Electric Co.

Reports received from a number of other projects indicate active work, but in most cases results are not yet ready for release and publication.

Of the two methods of test developed by the Joint Committee, one of these covering long-time (creep) tension tests (E 22-38 T) is to be revised as a Standard Recommended Practice for Conducting Long-Time High-Temperature Tension Tests on Metallic Materials and submitted for adoption as standard probably at the June, 1941, meeting in Chicago. The other method covering Method of Test for Short-Time High-Temperature Tension Tests of Metallic Materials (E 21-37 T) is being studied with researches under way to ascertain the effects of strain rate on the results of this type test.

On Saturday morning, November 2, an informal round table was held on problems in usage and testing of metals at elevated temperature, with especial emphasis on questions of embrittlement.

These meetings were under the direction of N. L. Mochel, Westinghouse Electric and Mfg. Co., *Chairman*, and J. W. Bolton, The Lunkenheimer Co., *Secretary*.

Committee B-4 on Electrical-Heating and Electric-Furnace Alloys

A LARGE NUMBER of standardization and research projects being carried on by Committee B-4 were discussed in detail at the recent meeting of the committee held at Battelle Memorial Institute, Columbus, Ohio, October 30 and 31. Seven subcommittees met and discussed their activities.

Inter-laboratory life test checks have been carried out by one of the subcommittees on a "Constant Temperature" test which it is thought may be more suitable for testing material for electric-furnace resistors, as well as inter-laboratory checks on the standard constant voltage life test.

The subcommittee on electrical tests has been very active, a contact testing machine having been devised and a number built for testing under various conditions. The tests cover a current range of 0.1 to 50 amperes.

The subcommittee on mechanical tests has been actively working on spring back tests on strip used in the manufacture of radio tubes and also investigating the possibility of using the same test for bimetallic strip for thermostats.

New methods of tests for wire for supports used in electronic devices and lamps and methods of testing lateral wire for grids of electronic devices have been prepared by Subcommittee VIII on Metallic Materials for Radio Tubes and Incandescent Lamps. This subgroup is also perfecting a test method for the determination of brittleness of tungsten wire used in incandescent lamps and another for welds used in the manufacture of incandescent lamps and electronic devices.

The subcommittee on methods of test for alloys in controlled atmospheres is continuing its investigation on the effect of furnace atmospheres on electrical heating elements. Some success has been met with in devising a laboratory test to reproduce furnace conditions and a study is now under way on the effects caused by variations in fuels where partially burned atmospheres are used.

Active Work Under Way on Electrical Insulating Materials

A SERIES OF INTERESTING meetings were held by Committee D-9 on Electrical Insulating Materials in New York City on November 14 and 15. In addition to the main committee, 15 subcommittees and sections held meetings.

A number of standardization and research projects were discussed and definite recommendations are to be presented in connection with two of the committee's standards, one including a revision in the Method of Testing Fin-Type,

Lime Glass Insulators (D 468 - 39 T); the other concerning a revision in the Methods of Sampling and Testing Untreated Paper Used in Electrical Insulation (D 202 - 40 T).

A new method of determining the punching quality of laminated phenolic sheets has been prepared and is to be presented to letter ballot of the committee. Two tentative methods are to be recommended for advancement to standard.

A technical paper on the punching quality of laminated phenolic sheets will probably be offered for presentation at the 1941 A.S.T.M. Annual Meeting.

Action was also taken to sponsor a research project to collect whatever data are essential to show that glass insulators tested in accordance with the Method of Testing Pin-Type, Lime Glass Insulators (D 468 - 39 T), in general, give satisfactory service.

Of particular interest in the field of liquid insulation are the activities concerning mineral base and synthetic products. After years of experimental work it is proposed to draft methods for determining sludging characteristics of mineral oils. The program of additional work also includes studies of used oil. Progress has been made on methods of test for synthetic liquid insulation and these methods are expected to be completed for early action.

The results of a very productive questionnaire concerning consumer use of A.S.T.M. specifications for varnished cloth tape were reported. These will be further studied and are influencing the program this year. Most of the replies show that A.S.T.M. methods are used for specification purposes but that there is some departure from the performance limits.

One of the active projects in which a great deal of interest has been evidenced is the development of reports on the significance of tests. These have been developed by a special subcommittee headed by Dean Harvey including in its personnel men who have been very active in this field. It was announced at the meetings that a number of additional articles had been prepared which it is anticipated may be included when approved in the 1941 compilation of A.S.T.M. Standards for Electrical Insulating Materials. In the 1940 compilation issued within the past two weeks there are six reports on the significance of the following: dielectric strength test, resistivity test, impact test, tensile strength test of molded materials, tensile strength test of sheet and plate materials, and power factor test.

The New York meetings were conducted by the Chairman, T. Smith Taylor, Newark College of Engineering, and the Secretary, E. J. Rutan, Consolidated Edison Co. of New York.

Meetings of Committee on Plastics

AT THE SERIES OF meetings held by Committee D-20 on Plastics at the Hotel Pennsylvania in New York City on November 12 and 13, the active work of the five subcommittees dealing with properties of these materials was reviewed, with much progress indicated. Meetings were under the direction of the officers of Committee D-20, namely, W. E. Emley, *Chairman*, National Bureau of Standards, and W. A. Evans, *Secretary*, Bell Telephone Laboratories, Inc.

Although in Subcommittee I on Strength Properties

there were no conclusions resulting from the studies on impact and tensile strength, a considerable amount of data have been accumulated on the form of the tension specimen, the appropriate testing jaws, and from a survey by questionnaire on the simplification of the Methods of Test for Impact Resistance of Electrical Insulating Materials (D 256 - 38) which test is sponsored by A.S.T.M. Committee D-9.

Subcommittee II on Hardness Properties reported favorable correlation for mar resistance, but unsatisfactory correlation with experience for wear resistance with a carborundum abrasion apparatus. Round-robin results on deformation under load are leading to a proposed method of test. A preliminary machine for measuring scratch hardness has been developed and was demonstrated.

As a result of work in the Subcommittee on Thermal Properties, there were issued during the year new standardized procedures for conducting flammability tests for thin sheet plastics (D 568 - 40 T). At the meeting alternate means of ignition were considered with no definite action reported. Methods for testing heat and flame resistance of plastics are under development as well as procedures for flow measurements and tests for coefficient of expansion.

Some of the optical properties being actively studied by Subcommittee IV are haze, refraction factors, polarization, surface irregularities, and surface brightness. A preliminary glossary of optical terms for plastics was presented.

In the work on permanence properties which is the responsibility of Subcommittee V considerable progress has been made in studies of resistance of plastics to heat, light, and moisture.

New Committee on Electrodeposited Coatings

AS A RESULT OF joint discussion in three of the Society's very active standing committees, A-5 on Corrosion of Iron and Steel, B-3 on Corrosion of Non-Ferrous Metals and Alloys, and B-6 on Die-Cast Metals and Alloys, a recommendation was received by the Executive Committee and favorable action taken at its October meeting to undertake the organization of a new standing committee on electrodeposited metallic coatings. It has become increasingly apparent to the membership of these three standing groups that because of the importance of the subject and in order to handle various problems more efficiently, a separate group would be desirable. With the organization of this new committee, each of the three groups will relinquish jurisdiction in this field with the exception that Committee A-5 will continue its work involving electrodeposited coatings of cadmium and zinc on steel. One of the reasons for this is the extreme difficulty of distinguishing between electroplated zinc or cadmium on steel for the purpose of "finish" and coatings of the same materials applied for "protection" purposes. The new committee, therefore, when organized, will have jurisdiction over specifications and methods of test for electrodeposited coatings with the exception of zinc and cadmium applied to steel. It is not intended that the new committee will be concerned with anodic coatings on aluminum.

Intensive Activity in Work on Copper and Copper Alloys, Cast and Wrought

CONTINUING THE WORK which it initiated more than a year ago, A.S.T.M. Committee B-5 on Copper and Copper Alloys, met in Washington recently, under the direction of C. H. Greenall of the Bell Telephone Laboratories, chairman of the committee. The vice-chairmen are H. H. Stout, Jr., of Phelps Dodge Copper Products Corp., and J. J. Kanter of the Crane Co.; C. H. Davis of The American Brass Co. is secretary. This committee, under the regulations of the Society, is responsible for specifications for commercial copper and copper alloys in cast or wrought form, for use as engineering materials of construction excluding products used primarily for electrical purposes.

At the dinner meeting of the Advisory Committee, Colonel J. W. Younger and Commander H. V. McCabe of the Army-Navy Munitions Board were special guests of Secretary-Treasurer C. L. Warwick of the Society who participated in the meetings. Colonel Younger and Commander McCabe both expressed their appreciation for the work that the American Society for Testing Materials, and Committee B-5 in particular, has done and is doing to cooperate with the federal agencies responsible for the procurement, without delay, of material for Government needs.

There are, as everyone knows, a large number of specification writing bodies. Each seems to have its own pet requirements, which makes the manufacturer's problem a difficult one and increases costs to the consumer. Soon after the start of the present war Committee B-5 realized that if it could blaze the way in coordinating specifications for copper-base alloys it would not only be helping National preparedness by obtaining higher quality of products but would also simplify the producer's problems and reduce costs to consumers.

As a start, the committee got in touch with the Federal Specifications Board and Army and Navy representatives and asked them to participate in a round-table discussion with committee members in order to coordinate the chemical compositions, physical properties, methods of tests, and tolerances of the various Army, Navy, and Federal Specifications with corresponding A.S.T.M. Specifications for the same material.

The committee has held a number of its meetings in Washington so that it would be easier for representatives of various interested Government departments to attend. That this has helped in securing active cooperation is evidenced by mentioning the various departments represented at this last meeting: namely,

War Department: Assistant Secretary of War's Office
Ordnance Department
Air Corps
Navy Department: Bureau of Ships
Bureau of Aeronautics
Army-Navy Munitions Board: Standards Section
National Bureau of Standards
Federal Specifications Board

Subcommittee I on Copper-Zinc Sheet and Strip, under the chairmanship of G. H. Harnden, has been active in

EDITOR'S NOTE.—One of the functions of Subcommittee XII, of Committee B-5, is the preparation of material publicizing the committee work. This article is based on information furnished by this group. The activities of Committee B-5 are an excellent example of what can be done with close cooperation of the interests concerned, under active administrative guidance as rendered by the committee officers.

working with the Frankford Arsenal on specifications for cartridge brass and gilding metal. This work has led to the revision and combination of two older A.S.T.M. specifications and the writing of three new ones.

Specifications for Cartridge Brass (B 19-29) and for Cartridge Brass Disks (B 20-29) have been withdrawn and new Tentative Specifications for Cartridge Brass Sheet, Strip, and Disks (B 19-40 T) prepared and coordinated so that they are in agreement with Frankford Arsenal Specifications FXS-278 and FXS-279 covering this material. Tentative Specifications for Cartridge Brass Cartridge Case Cups (B 129-40 T) for Gilding Metal Sheet and Strip (B 130-40 T), and for Gilding Metal Bullet Jacket Cups (B 131-40 T) have been written and coordinated with Arsenal Specifications FXS-267, FXS-227, and FXS-281, respectively. In the meetings during the year in which this work has been done there has been fine cooperation between the Government representatives and the other committee members and in all cases there was mutual adjustment of the specifications to bring them into agreement.

Subcommittee I also arranged with the Arsenal for round robin grain size tests on which work was recently completed in eight cooperating laboratories: Correlation of the data is now under way and when completed will be very helpful to all concerned in enabling both A.S.T.M. and the Frankford Arsenal to arrive at satisfactory limits of grain size for cartridge brass and gilding metal cups.

Further work on the correlation of A.S.T.M. specifications with various Government and Federal specifications resulted in discussion on the following specifications at the most recent Washington meeting: Navy Specification 47 B 2 INT; Federal Specification QQ-B-611A; and Army Specifications 57-160 and 57-171.

Subcommittee II on Copper-Tin Sheet and Strip, of which R. J. Wheeler is chairman, did not participate in the most recent Washington meeting but in previous ones has been working with Government representatives on the coordination of A.S.T.M. Specifications for Phosphor Bronze Sheet and Strip (B 103-40 T) with Federal Specification QQ-B-746, Navy Specification 46 B 14e, Army Specification 57-167, and S.A.E. Specification No. 77.

Subcommittee III on Copper-Nickel-Zinc Sheet and Strip, of which E. S. Bunn is chairman, last year drew up Specifications for Copper-Nickel-Zinc and Copper-Nickel Alloy Sheet and Strip (B 122-39 T) and has had under consideration, during the current year, minor revisions of these specifications. This subcommittee is also reviewing specifications under its jurisdiction to coordinate them with corresponding Government specifications.

Subcommittee IV on Miscellaneous Copper-Base Sheet and Strip Alloys, of which L. A. Ward is chairman, discussed at length proposed revision of Federal Specification for Silicon Bronze (QQ-C-591A) corresponding to A.S.T.M. Specifications B 96, B 97, B 98, and B 99. Further steps were also taken looking toward the correlation of A.S.T.M. Specifications for Copper-Beryllium-Copper Alloy Bars, Rods, Sheet, Strip, and Wire (B 120 - 40 T) with U. S. Army Air Corps Specification 11070-A, Navy Aeronautical Specification M-328, and S.A.E. Aeronautical Materials Specification 4650 all for the same material. Work was also begun on new A.S.T.M. specifications for sheet copper with which Federal Specification QQ-C-501 will be correlated.

Subcommittee V on Miscellaneous Copper-Base Wire and Rod Alloys, under the chairmanship of W. H. Bassett, Jr., has been active in the coordination work and met with the other B-5 groups in Washington. This subcommittee has added two new alloys to the former Standard Specifications B 21-29 on Naval Brass Rods for Structural Purposes, the specifications reverting to tentative and issued as B 21 - 40 T. Two new specifications have also been prepared, covering Copper Rods, Bars, and Shapes (B 133 - 40 T), and Brass wire (B 134 - 40 T). The subcommittee has proposed minor changes in Specifications for Copper-Silicon Alloy Rods, Bars, and Shapes (B 98 - 40). In line with the cooperation with Government departments, this subcommittee at the Washington meetings reviewed Army Specification for Special Copper Rod for Pressure Cylinders (57-154-1A) and advanced a number of suggestions to improve its provisions although the requirements for this material are so unique that no A.S.T.M. specification for it will be written.

Revisions in Specifications B 21 already referred to have coordinated it with Federal Specification QQ-B-636 and Navy Specification 46-B-6j. Specifications for Free Cutting Brass Rod for Use in Screw Machines (B 16 - 29) are being reviewed in order to coordinate them with Federal Specification QQ-B-611A.

Six new tentative specifications are being prepared by this subcommittee: one for leaded high copper alloy rod; one for hardware bronze; one for phosphor bronze rod and wire; one for nickel-silver rod and wire; another for aluminum bronze rod and wire to be coordinated with Federal Specification QQ-B-666 and A.M.S. Specification 4630; and another for manganese bronze rod and wire similar to Federal Specification QQ-B-721A.

Subcommittee VI on Condenser Tubes, of which G. C. Holder is chairman, has, during the past year, been working on minor revisions of Specifications for Copper and Copper-Alloy Seamless Condenser Tubes and Ferrule Stock (B 111 - 40 T) and has in course of preparation specifications for condenser tube plates.

Subcommittee VII on Copper or Deoxidized Copper Tubes, under the chairmanship of H. Y. Bassett, also met in Washington and proposed changes in several specifications under its jurisdiction to provide for a grade of pipe and tube suitable for welding. These changes were requested by the A.S.M.E. Boiler Code Committee and affect Specifications B 42, B 68, B 75, and B 88. Additional slight changes were also made in the last named specification.

Subcommittee VIII on Copper Alloy Tubes for General

Use, of which Alan Morris is chairman, has, during the past year, written new Tentative Specifications for Miscellaneous Brass Tubes (B 135 - 40 T) and made minor revisions in other specifications under its jurisdiction.

Subcommittee IX on Copper-Base Alloy Forgings, of which J. J. Kanter is chairman, has under consideration minor revisions in the Specifications for Copper-Base Alloy Forging Rods, Bars, and Shapes (B 124 - 39 T) which have been found desirable as a result of experience obtained from the use of the present engineering requirements.

Subcommittee X on Copper-Base Alloys for Sand Castings met in Washington under the direction of its chairman, G. H. Clamer. This committee has recently revised the Specifications for Copper-Base Alloys in Ingot Form for Sand Castings (B 30 - 40 T). Seven new specifications for copper-base alloy castings corresponding to the revised ingot specifications are now under consideration by this committee and will probably be adopted at the next annual meeting of the Society in June. Subcommittee X has been particularly active during the past year in coordinating A.S.T.M. specifications under its jurisdiction with corresponding Federal, Army, and Navy specifications. Among those specifications reviewed have been Federal Specifications QQ-B-671a and QQ-B-731a, Navy Specification 46-B-16b and A.S.T.M. Specifications B 7 - 39; and Federal Specification QQ-B-726, Navy Specification 49 B 3d and A.S.T.M. Specifications B 54 - 39.

Subcommittee XI on Methods of Test for Copper and Copper Alloys, under the chairmanship of A. J. Phillips, reviewed at the Washington meeting a proposed method for mercurous nitrate testing which has been developed in cooperation with the Frankford Arsenal. Also discussed was a proposed method for pin or expansion test of tubing and pipe.

Subcommittee XII on Publication of General Information, of which C. S. Cole is chairman, has under preparation a paper on the classification of wrought copper and copper-base alloys. It is also reconsidering the possibility of having all the A.S.T.M. specifications pertaining to copper-base alloys published as a separate compilation.

Report on Materials in Sea-Water

RECENTLY RECEIVED from the British Institution of Civil Engineers is the Eighteenth Report (1940) of the Committee in charge of studies on effect of sea-water on materials. This is a general discussion by J. Newton Friend of the results of the corrosion tests which have been carried out with ferrous specimens for periods of five, ten, and fifteen years at Auckland (New Zealand), Colombo (Ceylon), Halifax (Canada), and Plymouth (England).

There are a number of very extensive insert plates and diagrams in the publication. The chapters cover: typical sea-air corrosion, complete immersion in fresh water, exposure alternately to sea-air and to wetting by sea-water or spray, exposure to continuous wetting by sea-water, and comparison of the various results obtained with different conditions of exposure.

Copies of the publication in cloth binding can be obtained from William Clowes and Sons, Ltd., Axtell House, Warwick Street, Regent Street, W. 1, London, for 8s. 6d.

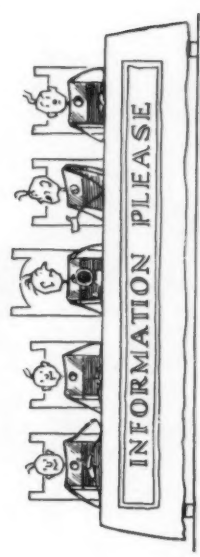
Questionnaire on Accelerated Testing of Paint Coatings

FOR SOME TIME the Society has been engaged in extensive cooperative investigations under the direction of Subcommittee VII of Committee D-1 on Paint, Varnish, Lacquer and Related Products, leading toward the development and standardization of accelerated tests for evaluating the resistance to weathering of organic finishes. The results of a symposium¹ on this subject in 1937 indicated considerable difference in opinion among experts with respect to the utility and reliability of various types of accelerated weathering tests. Group 7 of Subcommittee VII was therefore organized with the objective of obtaining information as to the extent of use and reliability of accelerated tests used for evaluating the serviceability to weathering of paint coatings. Group 7 is now circulating a questionnaire for this purpose and it is expected that the information gained will enable the committee to determine what tests and testing methods are in such general use as to warrant attempts to standardize them by the A.S.T.M. Since there may be readers of the BULLETIN who will be interested in filling out this questionnaire in order to further this work, it has been reprinted here. Completed questionnaires should be returned to H. G. Arlt, 463 West St., New York, N. Y.

¹ Symposium on Correlation Between Accelerated Laboratory Tests and Service Tests on Protective and Decorative Coatings, issued as separate pamphlet; for résumé, see *Proceedings*, Am. Soc. Testing Mats., Vol. 37, Part II, p. 467 (1937).

October 31, 1940

Return to H. G. Arlt
463 West Street
New York, N. Y.



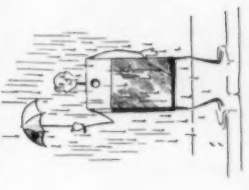
ACCELERATED TESTING OF PAINT COATINGS*

Use check marks to indicate your answers.

1. WHAT ARE YOUR INTERESTS?

Please classify yourself as:

Producer of Paints or of Paint Raw Materials
Consumer of Paints
General interest, that is, independent engineers, educators and persons who are
neither producers or consumers.



2. DO YOU TEST?

If you conduct any accelerated tests on paint coatings, please check
Please check, if you test
Maintenance Paint Coatings
Industrial Paint Coatings
Your opinions on questions 4, 5 and 6 will be appreciated regardless of your answers to this question.

3. HOW DO YOU TEST?

Please check the tests you employ in accelerated testing of paint coatings:

Paint Coatings for
Indoor Use
Outdoor Use

Outdoor Exposure, (Local only
Florida only
Several locations)
ACCELERATED WEATHERING CYCLES, including commercial weathering machines, homemade weathering machines or a combination of environments employing separate conditioning units such as ovens, cabinets, cook boxes, etc.



If accelerated weathering cycles are used, please check light source used.

Mercury Arc
Enclosed Carbon Arc
Open Carbon Arc
None

*By paint coatings we mean any organic coatings produced from materials such as, paint, varnish, lacquer, enamel, etc.

Long-Time Study of Cement Performance in Concrete

IT IS OF CONCERN alike to the producer and consumer of portland cement that the performance of concrete under the rigors of service cannot always be predicted or relied upon with certainty. These predictions are based upon premises which depend upon an attempted correlation of laboratory research and observation of field operations with field performance. Since the non-reliability of the predictions seems to be due to a lack of proper correlation between laboratory and field observations and field performance, the Portland Cement Association is about to undertake a long-time study of the performance of cement in concrete.

The program to be followed in this study has been developed by an Advisory Committee comprising twelve members of which P. H. Bates, is the chairman. From the accompanying list of the personnel of the committee it will be noted that of the twelve members, eight are from outside the cement industry and represent the point of view of the consumer, and four are from within the industry and represent the manufacturers.

MEMBERS OF THE ADVISORY COMMITTEE

From Outside the Cement Industry

- P. H. Bates, *Chairman*, Chief, Clay and Silicate Products Div., National Bureau of Standards, Washington, D. C.
Bryam W. Steele, Office of Chief of Engineers, U. S. Army, Washington, D. C.
J. L. Savage, Chief Designing Engineer, U. S. Bureau of Reclamation, Customhouse, Denver, Colo.
P. J. Freeman, Principal Materials Engineer, Tennessee Valley Authority, Knoxville, Tenn.
T. E. Stanton, Materials and Research Engineer, California Division of Highways, Sacramento, Calif.
Dr. Roy W. Carlson, Massachusetts Institute of Technology, Cambridge, Mass.
F. H. Jackson, Senior Engineer of Tests, Public Roads Administration, Washington, D. C.
R. B. Young, Testing Engineer, Hydro-Electric Power Commission, Toronto, Canada

From the Cement Industry

- R. G. Uhlig, Vice-President and Operating Manager, Missouri Portland Cement Co., St. Louis, Mo.
Hubert Woods, Chemical Engineer, Riverside Cement Co., Riverside, Calif.
Roy N. Young, Chemical Engineer, Lehigh Portland Cement Co., Allentown, Pa.
F. R. McMillan, Director of Research, Portland Cement Association, Chicago, Ill.
Ex officio: Frank T. Sheets, President, Portland Cement Association, Chicago, Ill.

The committee has defined the objectives of the study to be the determination of, first, the extent to which the performance of concrete is affected by differences in cement, and, second, the factors responsible for such differences. Emphasis is to be placed on a study of the characteristics of the cement in relation to concrete performance, and variations in concreting methods and workmanship are, in general, to be avoided.

In the conduct of the study, field structures will be built by usual methods, but under close technical supervision, and the cements used will be representative of the

whole range of commercially available products. These cements, during every stage of manufacture, will be subject to close scrutiny and exacting chemical and physical tests in order that the performance of the field structures as observed over a period of many years may be correlated with the characteristics of the cement. In the mill, complete records will be made of all significant data bearing on the proportioning of raw materials, burning, cooling, and storing of the clinker, and grinding and storing of the cement. Adequate samples of both clinkers and cements will be taken to permit application of every known test for the determination of the factors sought, and a large quantity will be stored for use in any future tests that may be devised or seem desirable. In addition, samples will be made available to interested and properly qualified laboratories for cooperative studies.

The cements selected for these studies fall, in general, into the five types defined by the Tentative Specifications for Portland Cement (A.S.T.M. Designation: C 150-40 T) with an extra group to cover specially treated cements (ground with tallow, vinsol resin, etc.). They will include representative cements of each type and those embodying various special characteristics, and attention will be given to the geographical distribution of the producing mills. In all, there will be 48 cements used, totaling approximately 35,000 bbl.

The field work will consist of ten major projects located in different parts of the country in order that a wide variety of conditions of soil, weather, and materials will be encountered. The cements to be observed will be incorporated into concrete structures of several different types; a number will be full size structures, such as highway slabs, bridge decks and handrails, parapets, etc., which will undergo the usual loading and weathering encountered by such structures, and non-service test specimens, as slabs, piles, columns, and box-type retaining wall sections.

Three of the principal projects will be experimental pavements constructed in cooperation with state highway departments under standard procedures in which cements representing the five standard types and the treated cements will be used. The pavements will be located in the northeast, southeast, and midwest sections of the country.

Two projects, similar to the above and in conjunction with them, will study variations in consistency and exposure with treated and untreated cements.

Three projects will study effects of variations in fineness of cement, and in burning and cooling conditions of the clinker. These experimental pavements will be private industrial roadways where close control of materials and workmanship will be assured.

One project will be carried out at two locations where the effect of soils high in sodium sulfate and magnesium sulfate, respectively, may be studied. Regular and special cements will be used in concretes of three different cement contents.

One project will study the effect of fresh and sea waters on the six types of cement, using reinforced concrete piles of normal cross-section and lengths. Concretes of different cement contents and consistencies will be tried out also.

Exposure will be in the Hudson River, and in the oceans in Maine, Florida, and California.

One project will feature the exposure of concretes containing the standard cements in thin sections in such structures as bridge decks, handrails, parapets, etc., to various conditions of frost and precipitation.

One project, using all the cements from the other projects, will study aggregates, mixes, and consistencies, in three types of specimens (slabs, walls, columns), exposed to northern and southern climatic conditions on two experimental farms.

The scope of this program, involving construction under close control, and observations over a period of years, of 90,000 sq. yd. of concrete pavement and an additional 2500 cu. yd. of concrete in miscellaneous structures, should yield in the years to come a wealth of interesting and valuable information on many phases of cement and concrete technology.

Engineering Properties of Gray Cast Iron

RECENTLY, THE Battelle Memorial Institute prepared a critical bibliography of the technical literature on cast iron, for the Gray Iron Founders' Society. The main purpose of the work was to collect and publish in convenient form valuable information on the engineering properties of this material, as these data are found in technical libraries and as recorded from the experiences of operating men and laboratory workers. Much of the published data are widely scattered in various books and periodicals and because of this, much information of value has not been studied or used. This new publication is divided into four sections.

Section One: Tabulation of the published data on the common mechanical properties of gray cast iron, followed by a discussion of the effects of section size, particularly on Brinell hardness, tensile, and transverse strength. In the preparation of the tables, the A.S.T.M. classification based on the tensile strengths of the various grades of engineering cast iron is used.

Section Two: Information on properties that are not usually determined, or which cannot be expressed in terms of a single test; also a discussion of those properties such as machinability, influence of combined carbon on cutting speeds, and of phosphorus on machinability, wear resistance of plain and alloy iron, corrosion resistance, and others that cannot be evaluated numerically.

Section Three: A selected bibliography with comment on the interrelation of the various properties of gray cast iron. Reference is also made to the A.S.T.M. specifications, as well as to specifications established by the different engineering societies in other countries.

Section Four: Bibliography. Literature regarding the engineering properties of gray iron, grouped by topic.

The book, spiral ring binding, 53 pages, 8½ by 11 in., is available at the office of the Gray Iron Founders' Society Inc., 1010 Public Square Building, Cleveland, Ohio, at \$10 per copy, postage paid.

Annual Reviews of Petroleum Technology (1939)

CONTINUING its practice of issuing annual reviews of petroleum technology, The Institute of Petro-

leum (British) has recently published Volume 5 covering the year 1939. This volume presents a survey of progress in the science and technology of petroleum during the past year so far as it has been recorded in published articles and patents. The publication provides access to a wide field of literature concerned with the subjects covered.

While this latest volume was published under the difficulties of war resulting in omission of some developments, in part because the authors did not have available certain published information and because of voluntary censorship resulting in the deletion of certain data, nevertheless, the volume seems an excellent continuation of the series.

Topics covered in detail by surveys include the following: petroleum geology, geophysics, drilling, production engineering, transportation and storage, refinery plant and engineering, cracking, pyrolysis and polymerization, gasoline, lubricants and lubrication, light distillates, Diesel and gas oils, fuel oils, automobile, aero and oil engines, asphaltic bitumen and road materials, analysis and testing, chemistry and physics of petroleum hydrocarbons, etc. A new chapter has been included on addition agents. Copies of this 6 by 9 in. cloth-bound publication, 464 pages, can be obtained from the Institute, c/o The University of Birmingham, Edgbaston, Birmingham, 15, at a price of 11 s., postage prepaid.

Calendar of Society Meetings

(Arranged in Chronological Order)

1940

NATIONAL ASPHALT CONFERENCE—Adolphus Hotel, December 9-13, Dallas, Tex.

NATIONAL CHEMICAL EXPOSITION—Stevens Hotel, December 11-15, Chicago, Ill.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE—Bellevue-Stratford Hotel, December 27-January 2, Philadelphia, Pa.

1941

SOCIETY OF AUTOMOTIVE ENGINEERS—Annual Meeting and Engineering Display, Book-Cadillac Hotel, January 6-10, Detroit, Mich.

AMERICAN SOCIETY OF CIVIL ENGINEERS—Annual Meeting, January 15-18, Waldorf Astoria, New York, N. Y.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS—Forty-seventh Annual Meeting, January 27-29, Hotel Muchlebach, Kansas City, Mo.

AMERICAN ROAD BUILDERS' ASSOCIATION—Annual Convention, January 27-30, New York, N. Y.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—Winter Convention, Bellevue-Stratford Hotel, January 27-31, Philadelphia, Pa.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS—Annual Meeting, February 17-20, New York, N. Y.

AMERICAN CONCRETE INSTITUTE—Annual Convention, February 18-20, Washington, D. C.

American Society for Testing Materials—Committee Week and Spring Meeting, March 3-7, Washington, D. C.; Annual Meeting, June 23-27, Chicago, Ill.

AMERICAN RAILWAY ENGINEERING ASSOCIATION—Annual Meeting, March 11, 12, and 13, Palmer House, Chicago, Ill.

AMERICAN CERAMIC SOCIETY—Forty-third Annual Meeting, March 30-April 5, Baltimore, Md.

AMERICAN CHEMICAL SOCIETY—April 7-11, St. Louis, Mo.

ASTM Bulletins—1940

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Questionnaire on Accelerated Testing of Paint Coatings. Committee D-1 on Paint, Varnish, Lacquer, and Related Products. No. 107, December, 1940, p. 47.

Adhesion

Testing Elasticity and Hardness of House Paints (Abstract). W. H. Hoback. No. 102, January, 1940, p. 12.

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Inert Materials for Admixture with Paint Pigments. Wayne R. Fuller. No. 105, August, 1940, p. 35.

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Phthalic Anhydride Determinations in Alkyd Resins. John McE. Sanderson. No. 107, December, 1940, p. 15.

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Committee on Building Stones and Slate Reorganized. No. 106, October, 1940, p. 43.

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Improved Sight Gage for A.S.T.M. Tests for Burning Quality of Kerosine Oils. T. H. N. Waite and M. M. Rhodes. No. 102, January, 1940, p. 19.

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Burst Test Data on Laminated Glass. W. R. Koch and E. J. Wyrostek. No. 103, March, 1940, p. 21. Discussion, p. 25.

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The Use of Radiography in the Development of Castings for Mass Production. Don M. McCutcheon. No. 103, March, 1940, p. 13. Discussion, p. 16.

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Cooperative Study of Quick Methods of Determining Silicon Dioxide, Calcium Oxide, and Magnesium Oxide in Portland Cement. W. C. Hanna, L. N. Bryant, T. A. Hicks. No. 103, March, 1940, p. 29.
How Many Specifications for Cement? Report of Special Subcommittee of Committee C-1 on Cement. No. 102, January, 1940, p. 39.
Long-Time Study of Cement Performance in Concrete. No. 107, December, 1940, p. 49.
Needed Improvements in the Cement Briquet Testing Apparatus. Paul Cloke and W. S. Evans. No. 104, May, 1940, p. 31. Discussion, p. 35.

Provisional Methods for Testing Sulfur Cements. P. V. McKinney. No. 106, October, 1940, p. 27.

Chemical Analysis

A Study of Methods of Testing and Chemical Analysis of Metallic Driers. W. T. Pearce. No. 106, October, 1940, p. 15.

Coal

An Electric Furnace for the Determination of the Softening Temperature of Coal Ash. H. L. Brunjes. No. 103, March, 1940, p. 35.

Color

Symposium on Paint Testing—Abstracts of Technical Papers. No. 102, January, 1940, pp. 11 to 19.

Some Fundamental Requirements of Colorimeters and Reflectometers. Richard S. Hunter.

A Method of Representing Color. Francis Scofield.

A Sheen Meter. J. W. Ayers.

Testing Elasticity and Hardness of House Paints. W. H. Hoback.

The Hegman Fineness Gage. E. W. Fasig.

The Aeration Test for Comparison of Thinners. D. D. Rubek.

Detective Work on Metal Finishes. V. M. Darsey.

An Apparatus for Determining the Durability of Heat-Resisting Paints. G. W. Ashman and S. Werthan.

The Conical Mandrel for Measuring Elongation of Attached Films. H. G. Arlt.

Cook Box Test for Anti-Corrosion Paints. E. W. McMullen.

Development of a Consistency Test. R. H. Sawyer.

1940 Review of the Inter-Society Color Council. No. 103, March, 1940, p. 34.

Test Proposed for Color of Orange Shellac. Report Submitted by Subcommittee XIII on Shellac to Committee D-1. No. 105, August, 1940, p. 49.

Compression Testing

Automatic Speed Control for Tension and Compression Testing Machines. R. K. Bernhard. No. 106, October, 1940, p. 31.

Rubber in Compression. E. G. Kimmich. No. 106, October, 1940, p. 9.

A Spring Suspended Spherical Bearing Block for Compression Tests. L. J. Markwardt and R. F. Luxford. No. 105, August, 1940, p. 27.

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Advances in the Uses of Concrete in Transportation (Abstract). Miles D. Catton. No. 102, January, 1940, p. 7.

Long-Time Study of Cement Performance in Concrete. No. 107, December, 1940, p. 49.

Condenser Tubes

Service and Life of Non-Ferrous Tubes in Petroleum Refining. E. S. Dixon. No. 102, January, 1940, p. 21. Discussion, p. 25.

Consistency

Development of a Consistency Test (Abstract). R. H. Sawyer. No. 102, January, 1940, p. 18.

Corrosion

Activities of Coordinating Committee on Corrosion. No. 106, October, 1940, p. 44.

Cook Box Test for Anti-Corrosion Paints (Abstract). E. W. McMullen. No. 102, January, 1940, p. 17.

Proposed Reference Standards of Rusting of Painted Iron or Steel Surfaces. Subcommittee VII on Accelerated Tests for Protective Coatings, of Committee D-1. No. 107, December, 1940, p. 25.

Service and Life of Non-Ferrous Tubes in Petroleum Refining. E. S. Dixon. No. 102, January, 1940, p. 21. Discussion, p. 25.

Detergents

Soaps and Other Detergents. H. P. Trevithick. No. 107, December, 1940, p. 9.

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A Study of Methods of Testing and Chemical Analysis of Metallic Driers. W. T. Pearce. No. 106, October, 1940, p. 15.

Effective Speaking

Let Us Consider Our Audience. S. Marion Tucker. No. 103, March, 1940, p. 27.

Fineness

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A Method of Representing Color. Francis Scofield.
A Sheen Meter. J. W. Ayers.
Testing Elasticity and Hardness of House Paints. W. H. Hoback.
The Hegman Fineness Gage. E. W. Fasig.
The Aeration Test for Comparison of Thinners. D. D. Rubek.
Detective Work on Metal Finishes. V. M. Darsey.
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Service and Life of Non-Ferrous Tubes in Petroleum Refining. E. S. Dixon. No. 102, January, 1940, p. 21. Discussion, p. 25.

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Yield Strength

Letter to the Editor on Yield Strength. No. 106, October, 1940, p. 36.

Company Uses 140 A.S.T.M. Specifications

Consolidated Edison Co. of New York Applies Specifications in Many Fields

NOTES IN THE BULLETIN on large construction projects and related activities with lists of A.S.T.M. specifications that have covered quality or testing of materials employed aroused much interest and it is proposed that occasionally there be brought to the attention of members and readers examples of either widespread use of Society standards or unique application of materials, the quality of which has been governed by standardized specifications and tests.

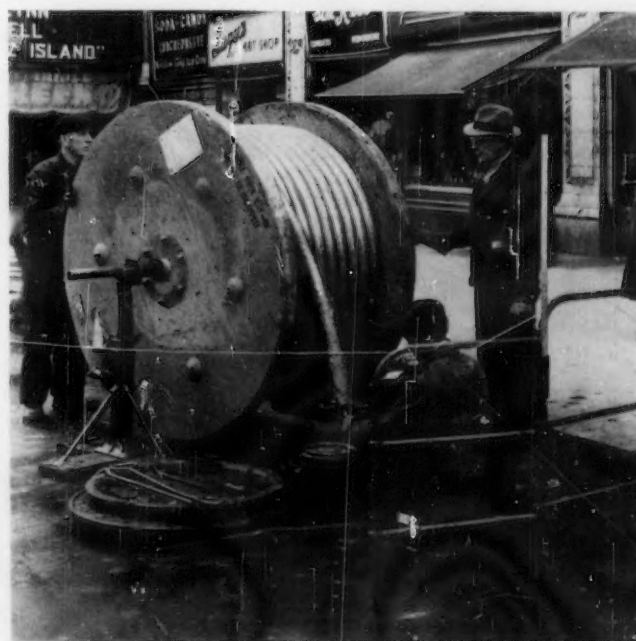
An outstanding example of the use of the Society's specifications and tests is in connection with the activities of the Consolidated Edison Co. of New York, which has kindly furnished the information set forth below.

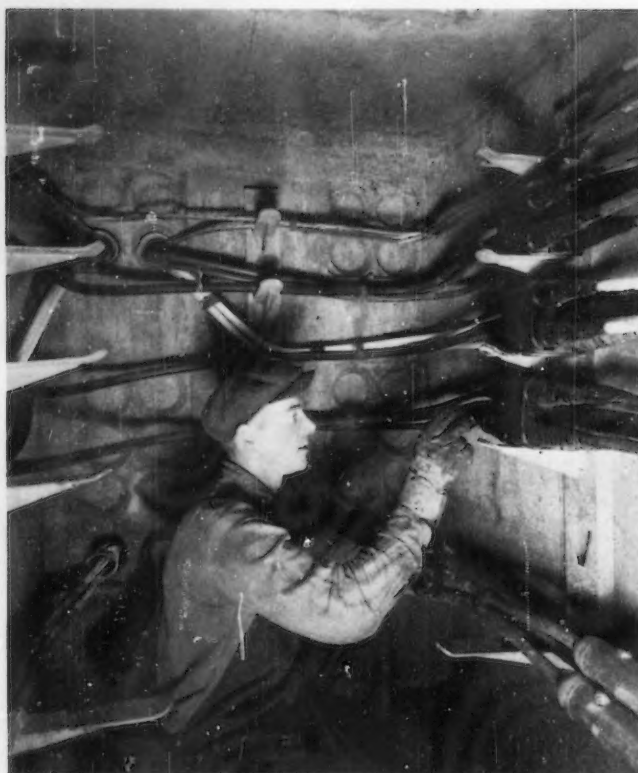
From the active participation of the Consolidated Edison Co. in the work of the Society (the company is a Sustaining Member in addition to having many of its engineering executives and technologists hold personal membership), being represented on upwards of ten standing committees, one would expect the organization to be concerned with quality specifications in a large number of fields. This is borne out by a review of the list of specifications used by the company.

As of March, 1940, the company employed 141 A.S.T.M. specifications and tests. (The number is probably greater now since additional materials of interest in power production were covered by new specifications accepted at the June A.S.T.M. meeting—for example, factory-made steel welding fittings for pressure piping, etc.) These covered so diverse a field that the work of some 23 standing committees of the Society was represented.

Beginning with the ferrous metals group, there are 36 specifications and tests covering various iron and steel

In the course of each year more than 8 million pounds of copper wires and cables are installed on the Consolidated Edison System in New York. They are purchased in accordance with A.S.T.M. specifications. The photograph shows cable being installed in an underground conduit system.





All joints and splices of cables must be carefully insulated. Various types of insulating tape and insulating compounds are used for this purpose. The Consolidated Edison Co. applies tests of the A.S.T.M. standard specifications to insure the safety and quality of this material.

products, metallic coatings on metals, and methods of testing including Brinell hardness, magnetic, tension, and compression. In the non-ferrous field, some 13 standards are employed covering various types of electrical conductors, copper products, solder metal, and the like. In the field of cement, concrete, lime, and related cementitious materials, twelve specifications are employed, and in addition there are 75 standards covering

Underground structures for the installation of electrical equipment and the splicing of cables are generally made of reinforced concrete. The structures vary in size from large vaults for the reception of current transformers to cable manholes and small cable splicing boxes. The reinforcing steel as well as the cement, sand, and stone are purchased in accordance with A.S.T.M. specifications. More than 235,000 pounds of reinforcing bars, 28,000 bags of cement, and 6200 cubic yards of aggregates are purchased every year for the fabrication of these structures.



materials such as paint, varnish, lacquer, and related materials, petroleum, rubber products, textile materials, electrical insulating materials in particular, and also a number in the field of coal and coke, and certain testing methods and procedures.

The accompanying illustrations and descriptive captions demonstrate effectively the use of different materials covered by the Society's specifications and tests.

While the very extensive use of A.S.T.M. standards by the Consolidated Edison Co. of New York may be somewhat unusual because of the wide range of materials involved in its services, it is certainly not exceptional. The significance of this seems clear; namely, that A.S.T.M. specifications in which the engineering and technical representatives of producers, consumers, and general interests have cooperated, are practical and fulfill the purpose for which they have been developed—to insure standards of quality for the materials covered.

Steel Castings Handbook

AFTER MORE THAN TWO years of intensive work gathering available information and technical data on the subject, the First Edition of a new and comprehensive Steel Castings Handbook has just been published by the Steel Founders' Society of America, Cleveland, Ohio.

The book was prepared as a reference volume for engineers and designers as well as a textbook for engineering students. It contains a wealth of material never heretofore published, and covers all phases of the steel casting industry and its products.

The data were reviewed by more than 70 experts who served on the various editing committees. All authoritative sources were drawn upon for material and all previously published literature was reviewed in the course of preparing the text.

Various divisions of the subjects are covered in 17 chapters beginning with history, definition and classes of castings, manufacture, physical values, heat treatment and the like. There is a section on engineering properties; an extensive chapter devoted to steel casting specifications with a critical discussion of many of those given; a section on recommendations to purchasers; and a chapter on commercial applications and industrial uses which incorporates a wealth of practical information. The book impresses one as having been efficiently edited, with a good typographic style. The large number of curves and tables selected are well set up to present the data given and the very large number of illustrations have been obtained from a great many sources throughout the country. Some of them are outstanding not only from the viewpoint of conveying information, but also from the standpoint of photographic technique.

The book includes some 510 pages and is bound in cloth. Every engineer interested in specification of materials should find of service a copy of this Handbook, which sells for \$2.00, postpaid. Orders should be addressed to Steel Founders' Society of America, 920 Midland Building, Cleveland, Ohio.

NEW MEMBERS TO NOVEMBER 18, 1940

The following 23 members were elected from October 3 to November 18, 1940:

Company Members (5)

- ARCO Co., THE, J. O. Small, Vice-President-Technical Director, 7301 Bessemer Ave., Cleveland, Ohio.
- BATH IRON WORKS CORP., S. H. Towne, Chief Engineer, Bath, Me.
- CHATHAM MANUFACTURING Co., G. Martin Coffyn, Advertising Manager, Elkin, N. C.
- GEIGY Co., Inc., V. Froelicher, Chemist, 89-91 Barclay St., New York City.
- JOHNSON BRONZE Co., J. B. Lasky, Chief Engineer, New Castle, Pa.

Individual and Other Members (15)

- BEACH, E. DONALD, Factory Manager, General Fibre Box Co., Springfield, Mass.
- FRICK, C. C., General Manager, William Hunt and Co., 150 Broadway, New York City.
- GEOHEGAN, K. P., Technical Director, The Aetna Paper Co., Dayton, Ohio.
- HEROLD, RICHARD, President, Sulzer Bros. Ltd., New York, 50 Church St., New York City.
- HOLCROFT, W. H., Vice-President, Holcroft and Co., 6545 Epworth Boulevard, Detroit, Mich.
- HUTTON, J. L., Owner, T. Shriver and Co., Harrison, N. J.
- IRWIN, E. M., Chief Engineer, Magnetest Corp., 3504 Atlantic Ave., Long Beach, Calif.
- OLESON, G. M., Sales and Technical Representative, International Paper Co., Southern Kraft Corp. Division, Room 3212, 220 E. Forty-second St., New York City.
- PEABODY, DEAN, JR., Associate Professor, Room 1-138, Massachusetts Institute of Technology, Cambridge, Mass.
- SAN BERNARDINO COUNTY PURCHASING AGENT, W. E. Young, Assistant to County Purchasing Agent, 328 Court House, San Bernardino, Calif.
- SHOCK, D'A. A., Chief Chemist, McGean Chemical Co., 2910 Harvard Ave., Cleveland, Ohio.
- SUTHERLAND, E. C., Associate Highway Engineer, Public Roads Administration, Division of Tests, Washington, D. C. For mail: 1736 G St., N. W., Washington, D. C.
- UNIVERSITY OF THE WITWATERSRAND LIBRARY, Box 1176, Johannesburg, South Africa.
- VOGDEN, J. F., JR., Engineer, Glen Gery Shale Brick Corp., Reading, Pa. For mail: 406 E. Church Lane, Philadelphia, Pa.
- VON SPRECKEN, T. M., Engineer of Bridges, Western Lines, Southern Railway Co., Transportation Building, Fourth and Sycamore, Cincinnati, Ohio.

Junior Members (3)

- BEALL, WAYNE, White Water Chemist, Champion Paper and Fibre Co., Hamilton, Ohio. For mail: 695 Marcia Ave., Hamilton, Ohio.
- MARCHAND, G. JULES, Inspector and Tester, Glenada, St. Maurice, P. Q., Canada.
- MILLER, J. A., Chemist, Waterbury Rolling Mills, Inc., Waterbury, Conn.

PERSONALS

News items concerning the activities of our members will be welcomed for inclusion in this column.

- L. D. CARVER, formerly Chief Chemist, Dunlop Tire and Rubber Goods Co., Ltd., Toronto, Ontario, Canada, is now Rubber Technologist, General Cable Corp., Rome, N. Y.
- POWELL PARDEE is District Sales Manager, Inland Steel Co., New York City. He was formerly Manager of the Order Department for this company and located in the Chicago Office.
- W. R. FULLER, who was affiliated with the Marietta Paint and Color Co., is now connected with the Grand Rapids Varnish Corp., Grand Rapids, Mich., as Technical Director.
- EDWARD BARTOW, formerly Professor and Head, Department of Chemistry and Chemical Engineering, State University of Iowa, Iowa City, Iowa, is now in the Research Laboratory, Johns-Manville Corp., Manville, N. J.
- W. J. JEFFRIES is now located in Philadelphia as Chief Inspector, Philadelphia Ordnance District, U. S. Army. He was Senior

Materials Engineer, U. S. Navy, Bureau of Ships, Navy Department, Washington, D. C.

C. L. CLARK, who was Research Engineer, Department of Engineering Research, University of Michigan, Ann Arbor, Mich., is now with the Steel and Tube Division, Timken Roller Bearing Co., Canton, Ohio, as Metallurgical Development Engineer.

J. B. MORROW, who was formerly Vice-President, Pittsburgh Coal Co., has recently become President of this company.

At the recent meeting of the American Welding Society, held in Cleveland, Ohio, the Lincoln Award, which is presented each year for the paper which contributes most to the year's development of welding, was made for the paper "Weld Hardening of Carbon and of Alloy Steel," presented at the 1939 annual meeting by H. J. FRENCH and T. N. ARMSTRONG, in Charge, Alloy Steel and Iron Division, and Metallurgist, respectively, The International Nickel Co., Inc.

C. H. STEVENS, Consulting Engineer, Philadelphia, Pa., and E. E. HOWARD, Member of Firm, Ash-Howard-Needles & Tammen, Kansas City, Mo., have been nominated for Vice-President and Director, respectively, of the American Society of Civil Engineers.

L. C. STEWART, Chemical Engineer, The Dow Chemical Co., Midland, Mich., together with several other officers and representatives of the company, discussed operations and product developments at the recent sales conference with the company executives at the general offices in Midland, Mich.

H. D. MATTHEWS is now with the W. M. Chace Co., Detroit, Mich., as Consultant and Research Engineer. He was formerly with Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

NECROLOGY

We announce with regret the death of the following three members:

SIR ROBERT A. HADFIELD, Chairman, Hadfields, Ltd., Hecla Works, Sheffield, England. Member since 1906.

W. B. STOREY, Former President, Atchison, Topeka & Santa Fe Railway Co., Chicago, Ill. Member since 1903.

W. W. YOUNG, Consulting Engineer, White Plains, N. Y. Member since 1908. Mr. Young was the first life member of the Society having subscribed to this class of membership in 1910, almost as soon as it was established.

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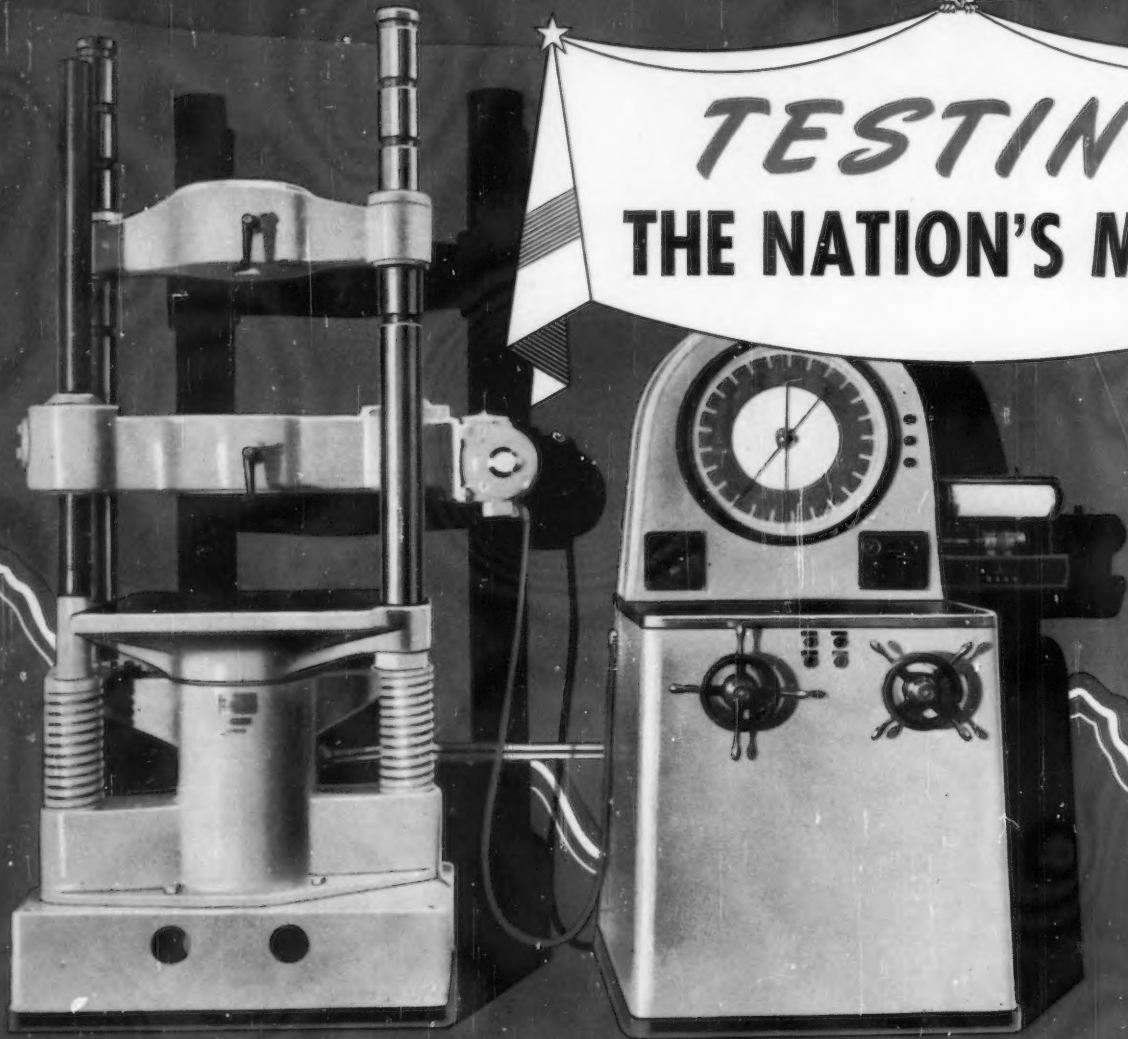
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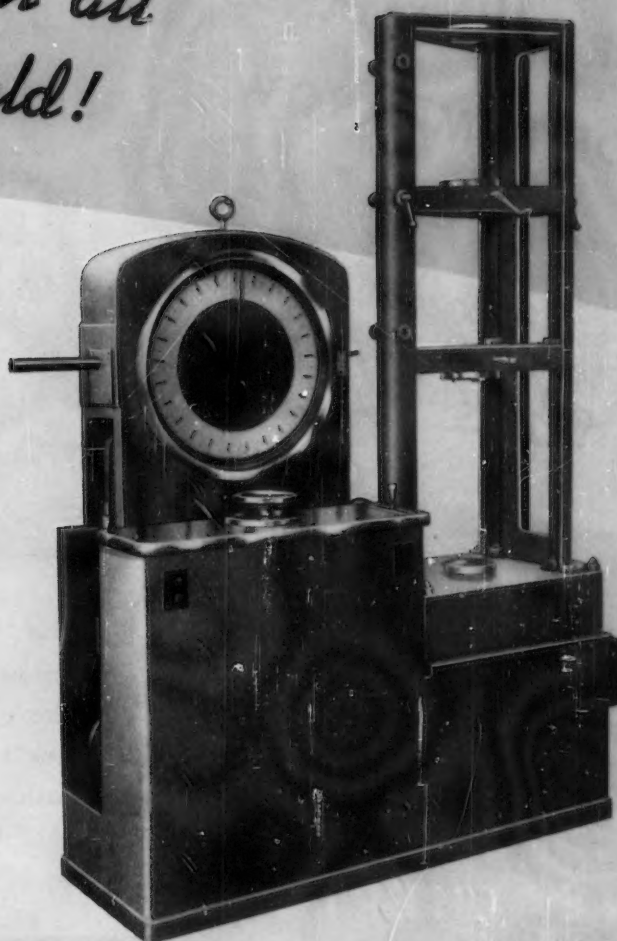
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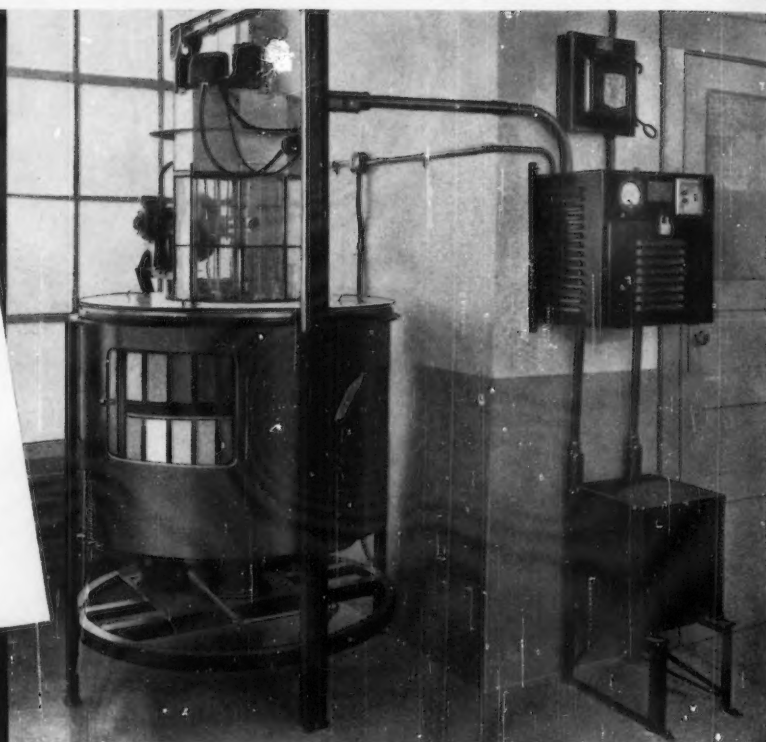
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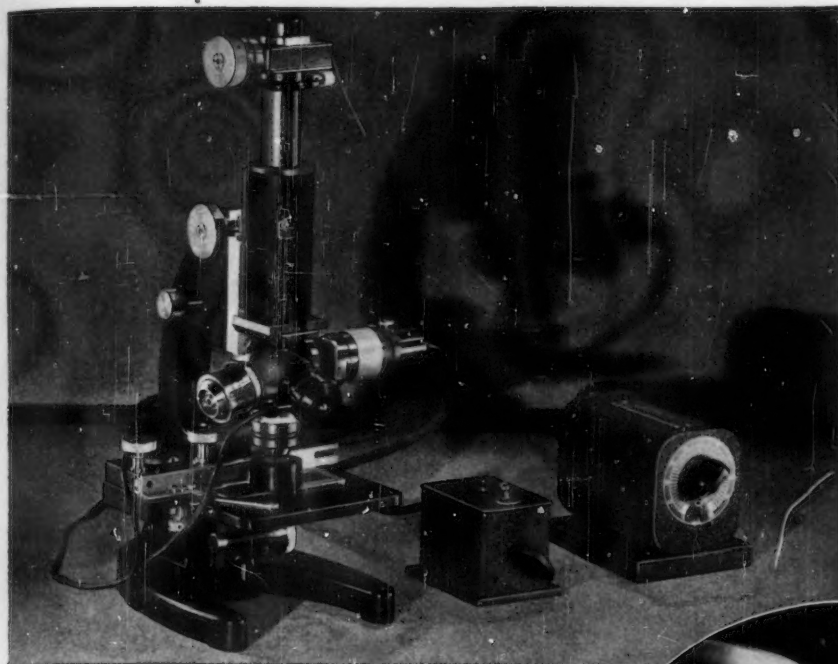
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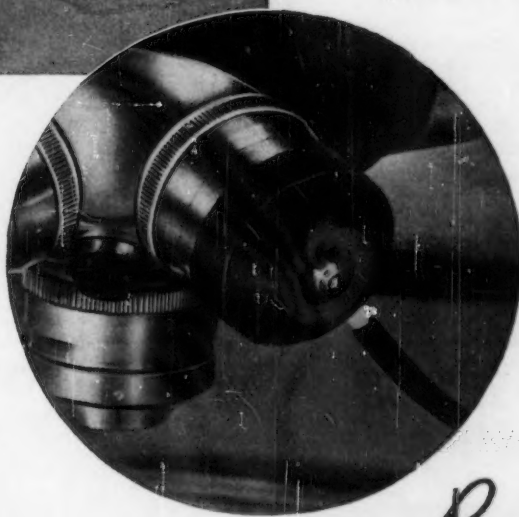
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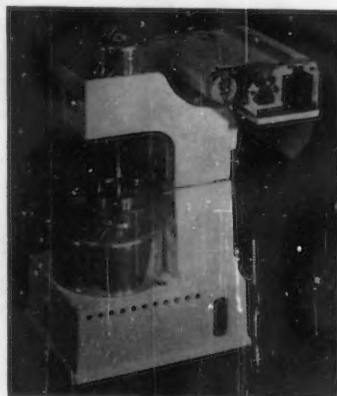
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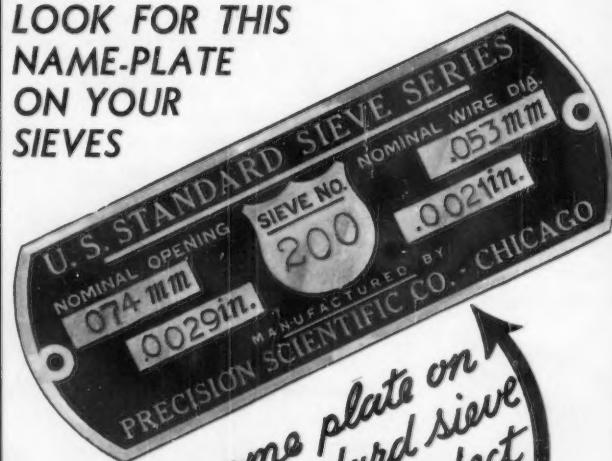
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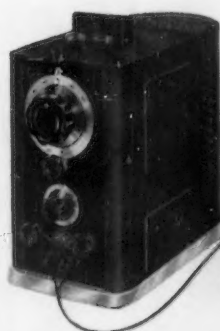
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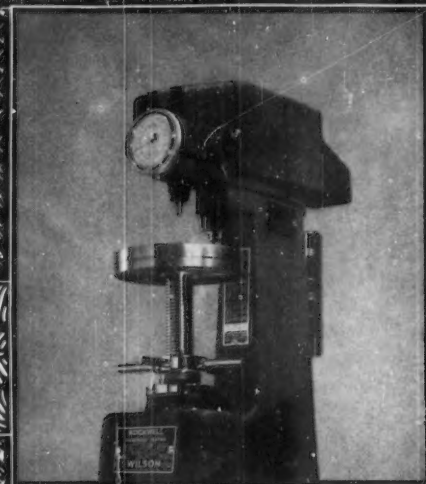
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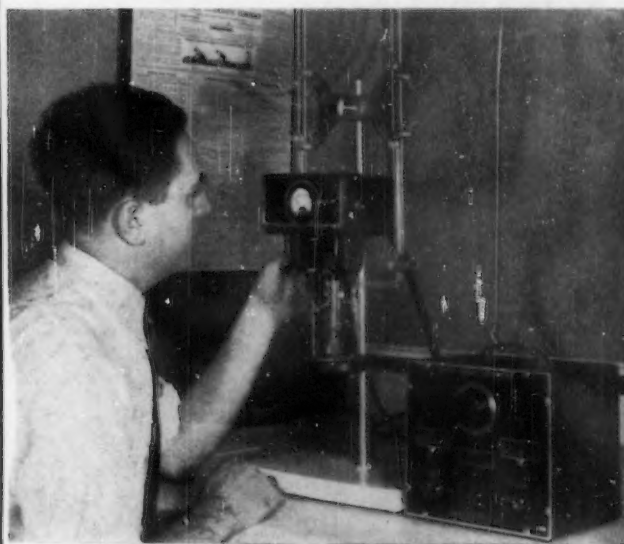
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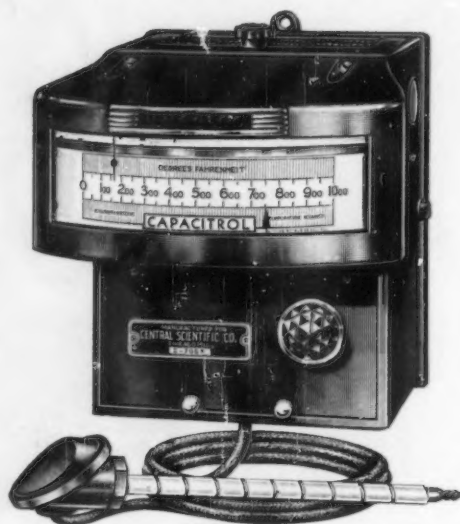
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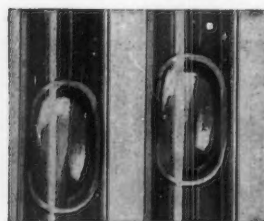
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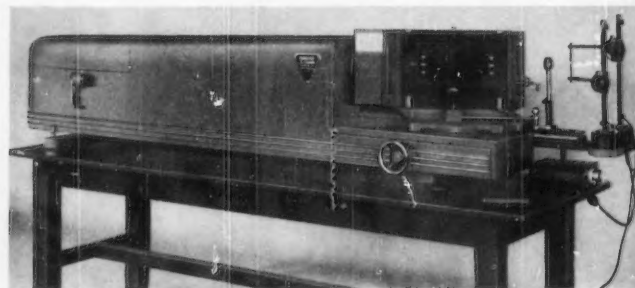
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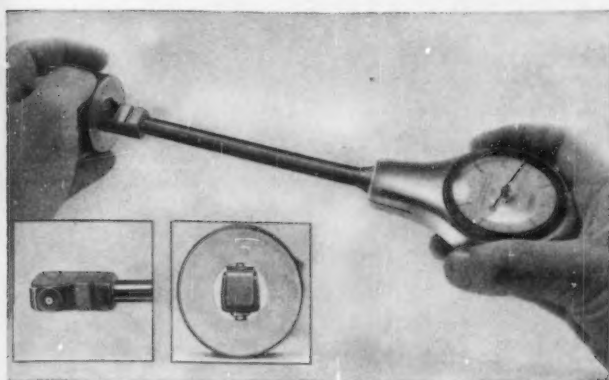
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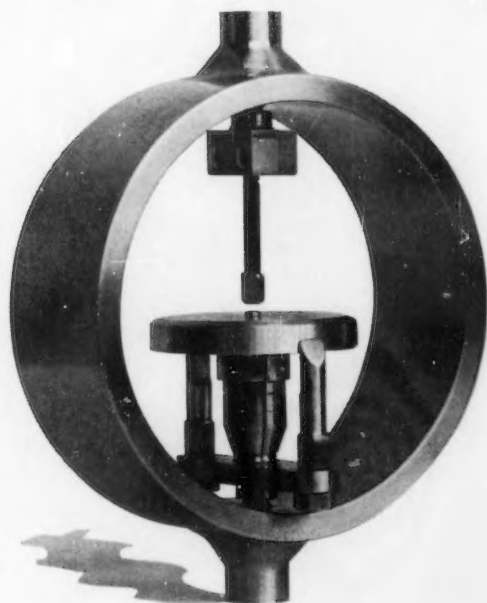


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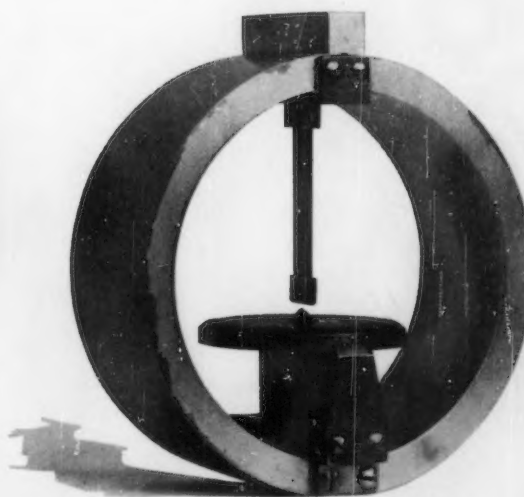
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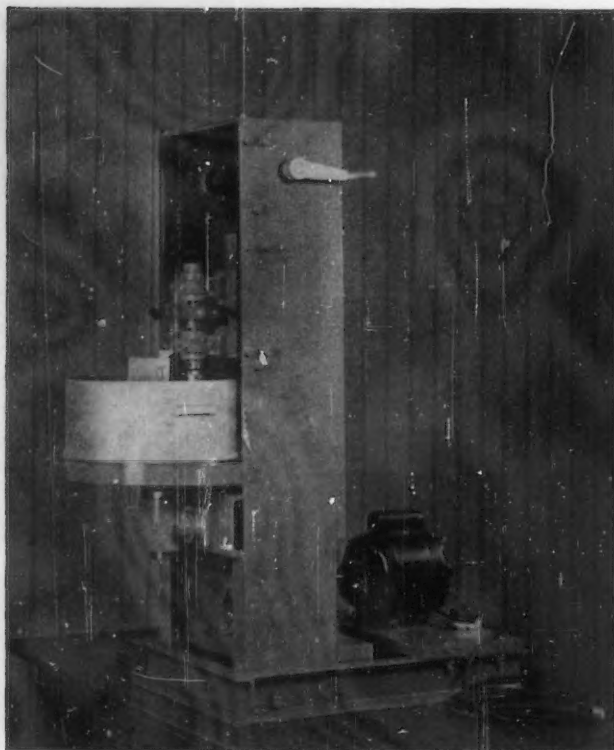


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